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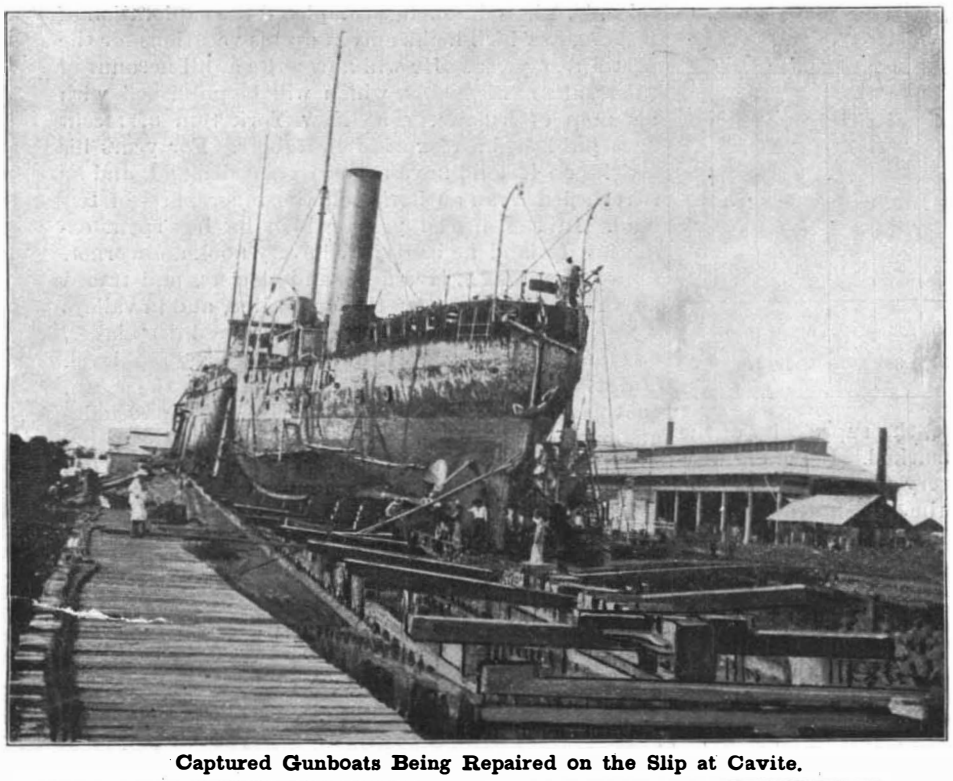
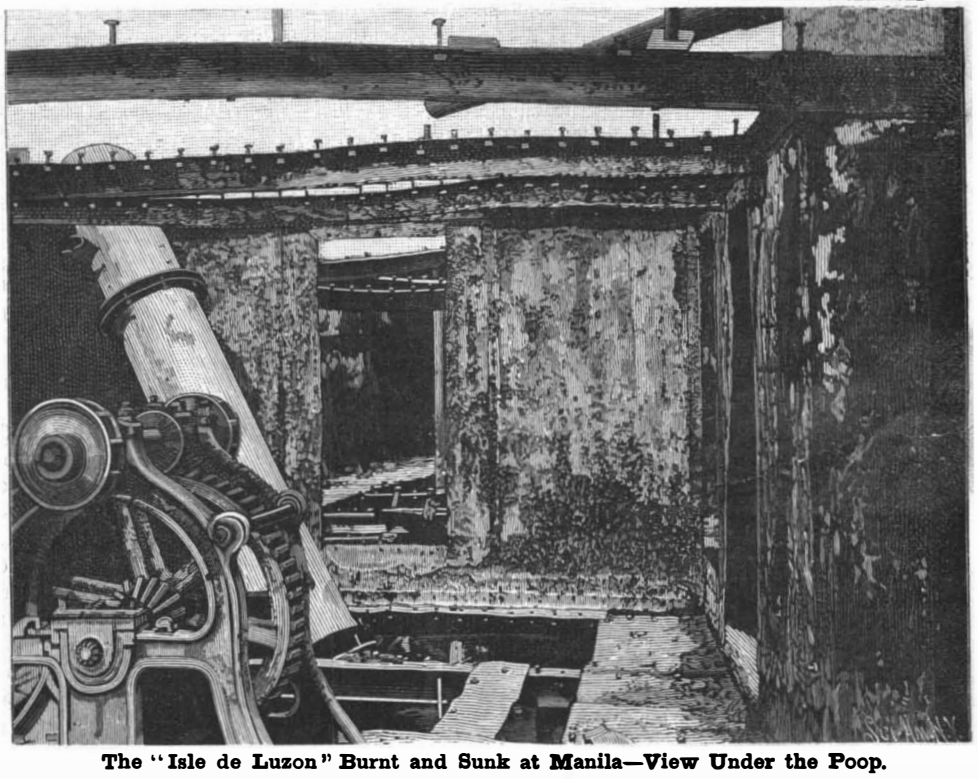
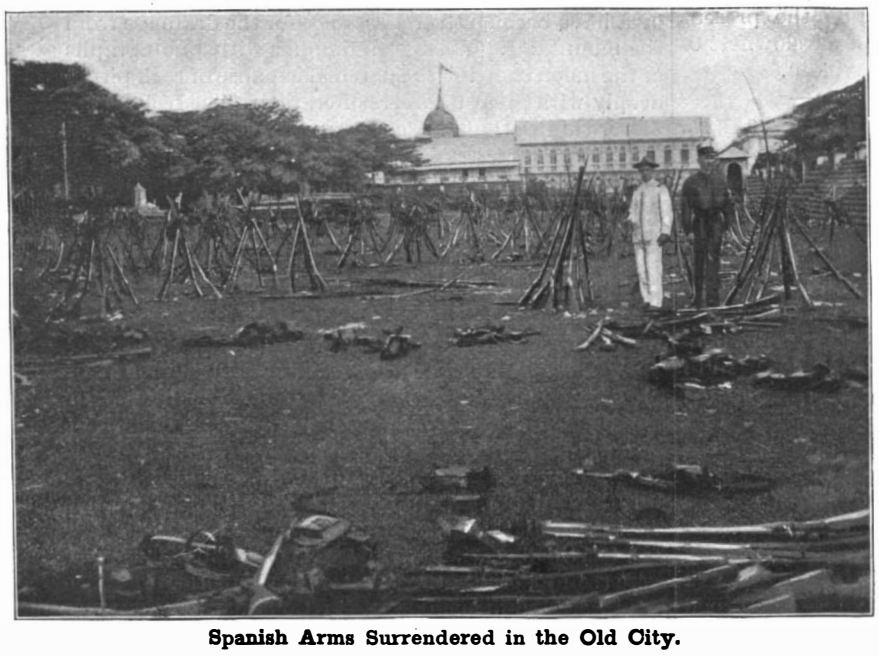


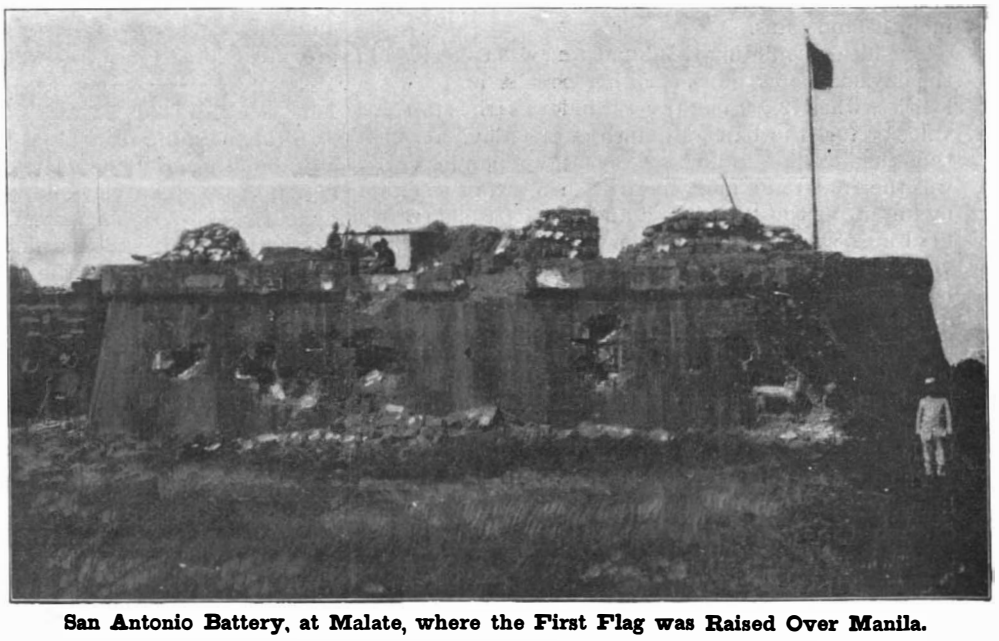
Captured Gunboats Being Repaired on the Slip at Cavite.



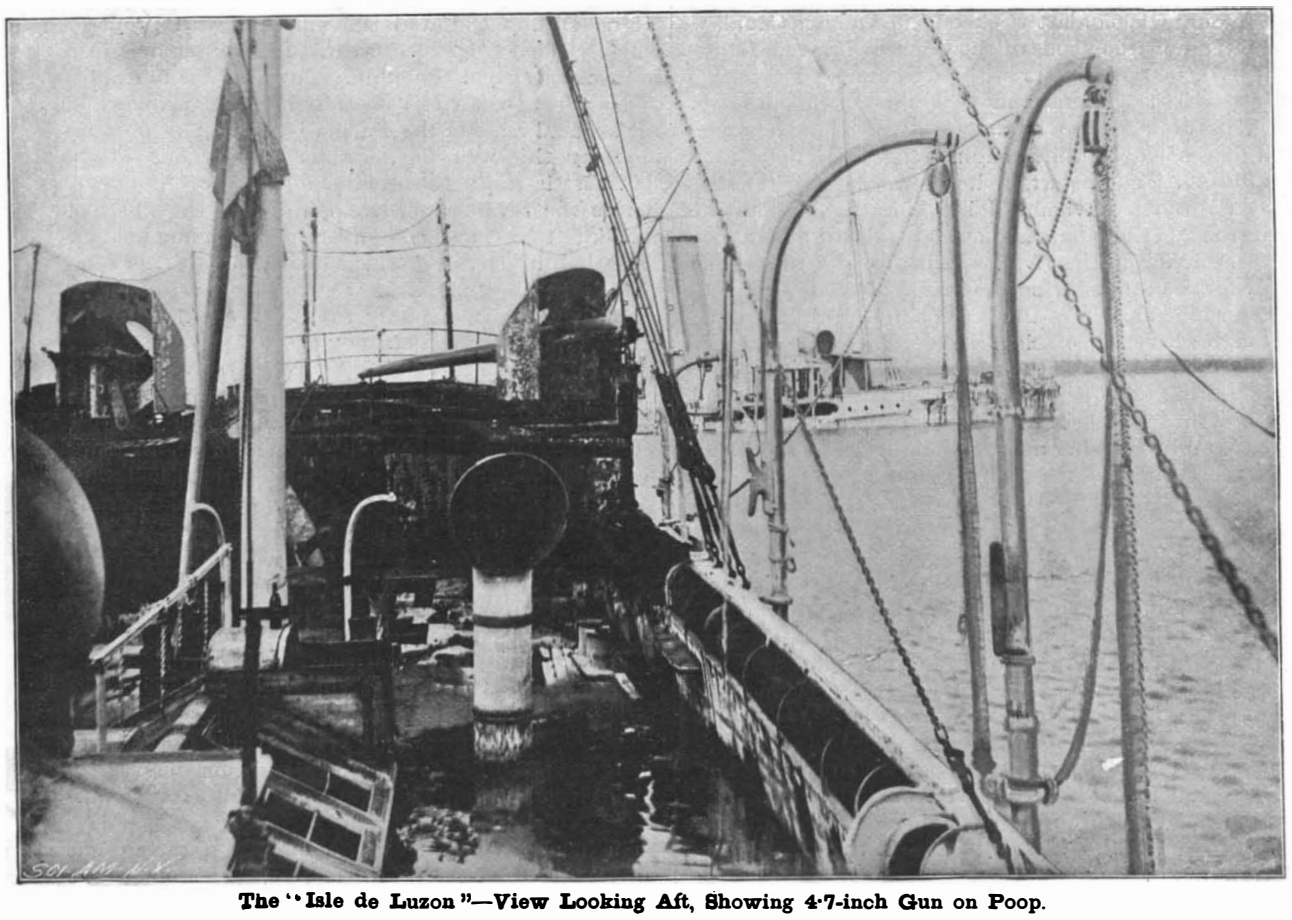
The "Isle de Luzon" Burnt and Sunk at Manila—View Under the Poop.



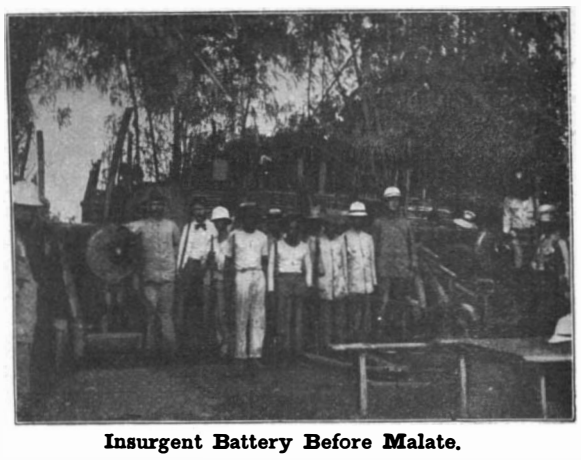
Spanish Arms Surrendered in the Old City.



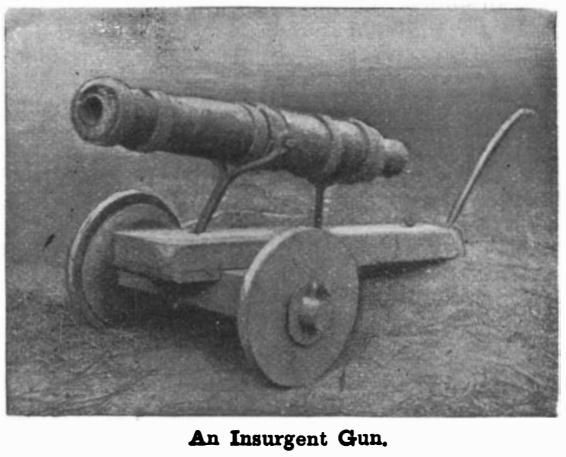
San Antonio Battery, at Malate, where the First Flag was Raised Over Manila.



The "Isle de Luzon"—View Looking Aft, Showing 4·7-inch Gun on Poop.



Insurgent Battery Before Malate.



An Insurgent Gun.

THE FORTIFICATIONS OF OLD MANILA.—[See page 87.]

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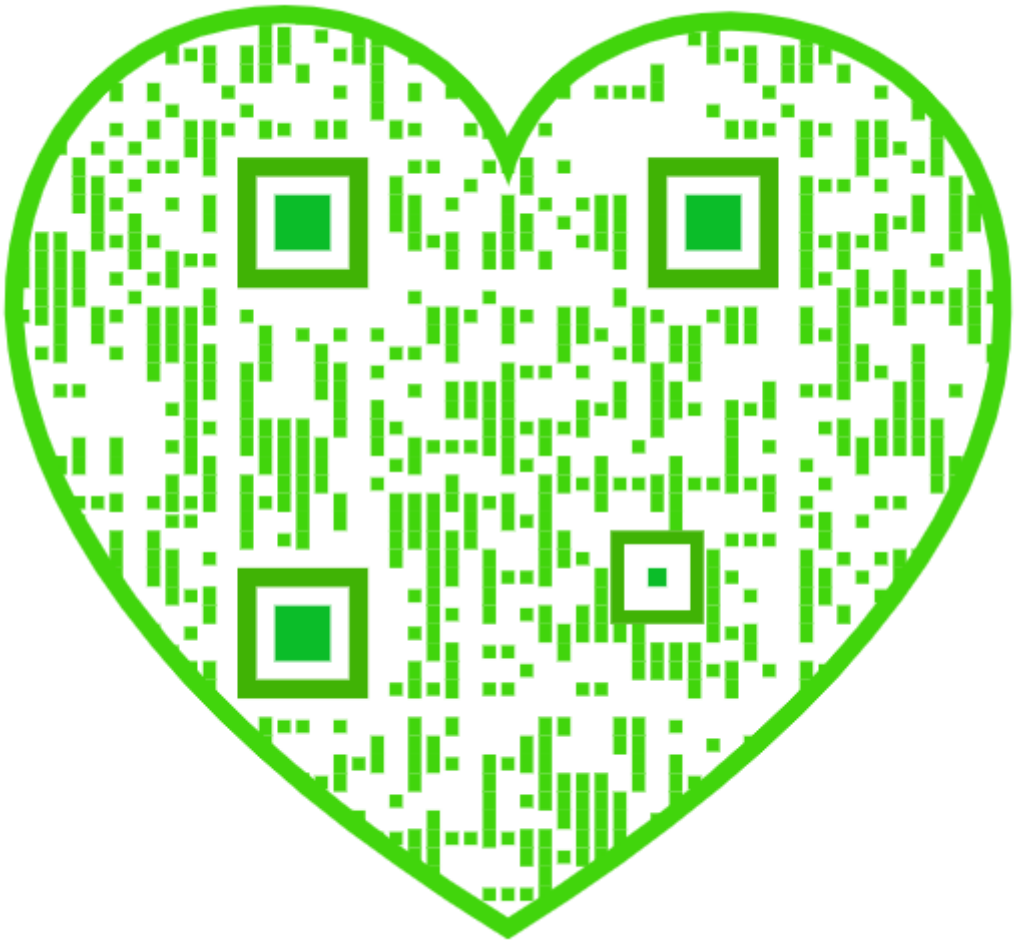

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NEW YORK, SATURDAY, FEBRUARY 11, 1899.

OUR FIRST AND LAST SIXTEEN-INCH COAST-DEFENSE GUN.

According to recent dispatches from Washington, the work of completing the first and probably the last "monster" gun to be built in this country is proceeding satisfactorily, if somewhat slowly. The new plant which it was necessary to install at Watervliet Arsenal to accommodate the great size of the gun has been completed, the forgings are delivered, and, if nothing goes wrong, the firing tests will take place in October of the present year.

By the time it is completed the new weapon will have afforded strong evidence of the fact that the fabrication of heavy ordnance is extremely slow and laborious; for several years will have elapsed between the date of its authorization by Congress and its completion. It will also demonstrate, in comparison with heavy guns of the latest type, that in the few years since it was commenced the manufacture of ordnance has advanced with such rapid strides as to render it, by comparison, an inferior weapon—slow in its rate of fire, of low velocity, and greatly inferior in the proportion of its energy to its weight.

For which reasons we shall not build any more 16-inch, 125-ton guns.

The idea of building this huge gun was conceived in the days of hooped guns, smoking powder and low velocities, when 2,000 feet per second was the standard velocity for the best ordnance of the day. At that time the heaviest and most powerful weapon in service was the 110½-ton gun of the British navy, of the kind mounted on the "Benbow" and "Sanspareil," which fired an 1,800-pound projectile with 2,087 foot-seconds velocity and 54,390 foot-tons energy, the penetration being 38 inches of iron at the muzzle and 26·5 inches at a distance of two miles. These huge guns were out of favor with the British authorities for several reasons, the chief of which was that the earliest of them showed longitudinal weakness. Although this was corrected in the later weapons, no more of the pattern were built.

The good results which were obtained with our own hooped guns, and the desire to mount a few weapons of extraordinary power to command our most important channels, led to the authorization of the present weapon. It is of the hooped pattern, and there is not a question that the improvement in materials and manufacture which has taken place in the fifteen years since the big English guns were built, will result in the new 16-inch weapon possessing ample strength and durability in every particular.

The finished gun will be 5 feet in outside diameter at the breech and 2 feet 3 inches at the muzzle. Its total length will be a few inches under 50 feet. The powder chamber will be 18 inches in diameter by 9 feet in length and will hold for a full charge over half a ton of brown powder. The projectile will weigh 2,370 pounds. It will leave the muzzle with a velocity of 2,000 feet per second, and at this velocity the flying mass will have a striking energy of 64,084 foot-tons, or sufficient to lift sixty-four of the biggest freight locomotives 10 feet in the air. At the muzzle the shell would punch a 16-inch hole through an iron plate over a yard in thickness and at two miles distance it would pass through a 27½-inch plate.

In spite of its great power, however, we shall probably never build another of its kind, for while it is the most effective weapon of the type in favor eight or ten years ago, it does not compare in efficiency with ordnance of the modern type, as the following considerations will show. The test of the efficiency of an armor-piercing gun is (other things being equal) the ratio of its penetration to its weight. Of two guns, if one will shoot through the 18-inch belt of a ship and the other will penetrate only 16 inches, the former gun is worth half a dozen of the latter; for the one shot that finds its way into the engine room will cripple the ship, where the half-dozen partial penetrations would leave her free to continue the fight. Again, if two heavy guns, each capable of penetrating 18 inches of armor, weighed respectively 30 and 60 tons, the first would be a vastly more efficient weapon, for two of the lighter type could be mounted on a ship to one of the heavier, or in the case of coast defenses two of the former could be employed for the cost of one of the latter.

Applying this to the 16-inch gun, we find from the accompanying table that it ranks far below the latest guns in efficiency; for although its total energy is about 33 per cent greater than that of our proposed 12-inch navy gun, its penetration is about 20 per cent less, while its energy per ton of gun is over 40 per cent below that of the English gun. Moreover, at the rate of $1,000 per ton, the 16-inch weapon will cost $125,000, as against $55,000 for our new navy weapon. Hence we see that as between the 16-inch and 12-inch guns for a given appropriation we can, by building the smaller weapons, secure over twice as many guns, of much greater penetration and efficiency.

TYPE OF GUN.	Weight in tons.	Length in feet.	Weight of projectile.	Muzzle velocity, feet per second.	Muzzle energy, foot tons.	Penetration at muzzle, iron in inches	Muzzle energy per ton weight of gun.
U. S. Coast Defense 16-in..... ..	125	50	2,370	2,000	64,084	39 0	513
English Wire-wound Navy 12-in...	50 3	41·4	850	2,750	44,573	45 9	886
Proposed U. S. Navy 12-in.....	55	50	850	2,000	48,000	48 8	873

In respect of rapidity of fire, the superiority of the 12-inch guns is even yet more marked. If the big weapon delivers a shell once in every five minutes, it will be doing good work; whereas, the 12-inch weapon, with its new Weling breech-mechanism, will be capable of firing a shell every minute or minute and a quarter. When we bear in mind the great speed of modern battleships and the short time they would be within close range in passing a fortification, the slowness of fire of the big gun will rob it of 75 per cent of its value.

It should, of course, be remembered in the above discussion that a new 16-inch gun would be built to use smokeless powder with its high velocities, and that its energy would be increased in proportion. But such an increase is not necessary—we have in the present guns all we need—and the objection of slowness of fire, unwieldiness and cost would still remain.

THE WATER SUPPLY OF THE PANAMA CANAL.

In the planning of a great ship canal like the one now building at Panama, or that proposed at Nicaragua, in which an elevated "divide" is surmounted by means of a series of locks, the fundamental problem to be solved is that of securing a sufficient and permanent supply of water at the summit level to compensate for losses due to the intermittent flow of water from the higher to the lower levels, which occurs whenever a vessel passes through the locks. In addition to the loss due to lockages, there is a steady diminution of the water in the canal as the result of evaporation and of seepage through the material in which the canal is built. Now, while all the other problems of canal construction are of a kind which, given time and money, the engineer can ultimately overcome, this question of water supply is one which is absolutely determined by the natural conditions of the locality. In other words, if there is not available a watershed whose annual rainfall will provide the necessary supply, the canal can never be built.

In our article of last week on the Panama Canal, we showed how the floods of the Chagres are to be stored in two great reservoirs with a combined capacity of 66,000,000,000 gallons, and that this turbulent river, which threatened to be the worst enemy of the undertaking, has, by skillful engineering, been turned into its best friend, a part of its flood waters being converted into a navigable lake, lying along 13 miles of the route of the canal, and a part being stored in a great reservoir far up the river, which provides ample supply for the canal during the season of drought.

For nine months of the year the natural flow of the Chagres River is sufficient to feed the canal and meet the losses due to evaporation, seepage and lockage; but during the dry season, which lasts from January 15 to April 15, there will be a deficit, which must be made up by drawing upon the water impounded within the Alhajuela reservoir, above referred to. The amount of water used by the locks, assuming 24 passages per day as a maximum and a mean of 15, will be, after allowing a liberal margin, 319,674,256 United States gallons per day. Adding to this the waste and loss of various kinds, the total daily use would be 528,388,000 gallons, which for three months, or 90 days, would equal 47,555,000,000 gallons. Now, the mean discharge of the Chagres during this period is 34,345,000,000 gallons. The deficit is, therefore, 13,210,000,000 gallons. To meet this there is stored in the Alhajuela reservoir a reserve of 35,000,000,000 gallons, which would carry the canal through a dry season lasting for over half a year, or through a drought the like of which is not written in the history or told in the traditions of the Isthmus.

With a view to making it possible to add at any time to the capacity of the dam, the structure was given a sufficient margin of stability to permit of the height of the crest being raised ten feet above its present level. This would increase the storage by 23,800,000,000 gallons, and give a total reserve of 58,800,000,000 gallons to meet a deficit of 13,209,680,000 gallons. Should a further margin be deemed necessary, that part of the flood waters of the Chagres which, in the present scheme, will flow through the weirs, could be impounded in various smaller up-stream reservoirs, as is now done in the Croton River watershed, in connection with the water supply of New York city.

EXPLORATIONS IN ICELAND.

Mr. T. Thoroddsen has completed the exploration of Iceland, to which he has given up his vacations for the past fifteen years. He will now write a full account of the results of his labors, which will be published with his map of Iceland. The New York Sun of recent date published a résumé of his labors. For years his articles on Iceland have been in great demand, and he is regarded as an authority on the inner parts of Iceland. In the fifteen years which he has spent exploring Iceland he has visited every nook and corner, found hundreds of lava fields and glaciers, and traced all the indentations of the coast line, and in valleys scooped out of tough basalt has discovered deep lakes, one of the lakes being 100 feet above the sea level, and its bottom is 275 feet below the level of the ocean. In the fifteen years he has traveled over 8,000 miles among the sandy level wastes. It is not surprising that the exploration of inner Iceland has been left so long, as the field was so small and far away that explorers thought they might win greater laurels in other parts of the world in which the public was more deeply interested. Travel in Iceland is particularly difficult, owing to the fact that large areas of lava-strewn land are destitute of verdure and Mr. Thoroddsen has often been compelled to carry fodder for his horses for many days at a time. There are no roads, and the summer season, which is the only time when travel is possible, is short. He has discovered scores of crater lakes scattered all through the interior. Many craters that help to cover the surface of Iceland with lava have become the receptacles for the drainage from the mountains. We are all familiar with photographs of the moon showing the parched expanse of rock pitted deeply with great numbers of craters. The Iceland explorer thinks that the country around Vatna Jokull would be a terrestrial counterpart of the surface of the moon were it not for the atmosphere and the water of greenish tinge that fills two-thirds of the yawning cavities.

HONOLULU'S GREAT MUSEUM.

In the Bishop Museum of Honolulu, the history of Hawaii is spread out as on a printed page. The New York Tribune recently had an interesting account of the museum. Funds were needed for the library of the Historical Society at one time, and an exhibit of Honolulu's antiquities was suggested as a means of raising money. Mrs. Bishop, who is descended from a long line of native kings, and Queen Emma showed the relics that they possessed. Others also contributed, and for the first time these various small collections were seen together; the effect was a surprise to every one interested in such matters. So much interest was taken in the exhibition that it was decided to keep the objects all together and the collection grew rapidly.

Mrs. Bishop endowed the museum with property which yielded $86,649 last year. The museum is in a western suburb of Honolulu. The idea was to exhibit and preserve the relics of Mrs. Bishop's people and the kindred races of the Pacific Ocean. The most interesting thing in the museum to any one not a specialist is easily the great collection of "kahilis." Before the revolution there were 105 in the museum, and since that time the number has been augmented. The "kahili" is the glorified descendant of the common fly brush, and but few great ones remain outside of the museum. Only royalty is entitled to the extraordinary insignia of the "kahili."

These affairs are carried before royalty or left to mark its tomb and perish by the weather. Some of them are gorgeously shaped like enormous bottle brushes, the feathers being splendid plumage of all kinds of birds and the long wooden handles embellished with ivory, mother-of-pearl, and costly woods, and occasionally a shark or human tooth to give interest.

In the same room with the "kahilis" the other relics of Hawaiian royalty, the "ahullas," or feather cloaks and capes, are kept. These are truly wonderful affairs made from feathers of the mamo bird, now said to be extinct, or from the small tuft of feathers found beneath the wings of the oo bird. The collection of enough feathers to make one of the magnificent cloaks often took many years. Only pre-eminent chiefs were entitled to wear the gorgeous mantles of golden feathers, and the appearance of the sable warriors when clad in these was regal.

The helmets which covered the heads of the ancient warriors are extremely interesting, resembling the Roman helmets and the Greek headdress. Most of them are covered with canary and red feathers, which

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were the favorite form of ornamentation in Hawaii. There are weapons edged with sharks' teeth, which went with these feathered marks of state, and hand daggers, which were fashioned at the time the first voyagers came to the island. In the museum there is also a collection of Hawaiian birds, containing many choice specimens, not a few of which are now extinct. The museum also includes many specimens of mats, native Hawaiian cloth beaten from the inner bark of the paper mulberry tree, wooden bowls and dishes, some of them being nine feet in circumference, nets, hooks, native sleds, weapons, etc.

Very few of the images of the Hawaiian gods remain in Hawaii. Most of them were taken away to American and European museums. There are a few, however, in the Bishop Museum, and an effort is being made to buy back as many as possible. The collections from Fiji, Society and Solomon Islands are very interesting. The art gallery is not particularly notable. The Bishop Museum is destined in time to become one of the most noteworthy institutions in the world. It is not likely that any similar collection will be founded in any of the other Polynesian islands for many years. Meanwhile the museum is collecting and preserving objects that are of priceless value in throwing light upon the history and evolution of a most interesting people.

THE EIGHTH INTERNATIONAL GEOLOGICAL CONGRESS, PARIS, 1900.

The Seventh International Geological Congress, at its meeting on September 3, 1897, decided to accept the invitation of the geologists of France to hold the eighth congress in Paris in 1900. The French geologists have formed a committee of organization, consisting of sixty of their number, and have just issued the first circular of information regarding the congress, and they present a very attractive programme. The officers of the committee are: President, Albert Gaudry; vice-presidents, A. Michel-Lévy and Marcel Bertrand; secretaries, Charles Barrois, Cayeux, Léon Bertrand, Thévenin and Thomas; treasurer, L. Carez.

The sessions of the congress will begin on the 16th and close on the 28th of August, 1900. The length of the meeting will allow members of the congress time to visit the "Exposition Universelle," to study the geological museums in the city, and take part in the geological excursions offered in the vicinity of Paris. The sessions will take place in one of the buildings of the Exposition, and those members of the congress who desire to exhibit geological maps, sections, photographs, and specimens are asked to apply to the commissioner of their own country, who will reserve for them a place in the proper class.

The committee of organization will strive to show the geology of the whole of France to the members of the congress; but to avoid too great crowds and to facilitate as far as possible the studies of specialists, it has been decided to organize a large number of simultaneous excursions, which will take place before, during, and after the business sessions. The excursions will be of two kinds; the general, open to the greatest possible number of members; and the special, reserved for specialists and limited in numbers to twenty participants each. The full itinerary of the excursions has not yet been published, but a preliminary skeleton can be given now which will show what rich treats are in store for those who can avail themselves of the opportunities offered.

Three general excursions are planned: A series of short ones among the celebrated fossil localities of the Tertiary basin of Paris, which will take place during the sessions of the congress; one of ten days into Boulonnais and Normandy for the study of the cliffs of the Manche River and the classic fossiliferous beds of the Cretaceous and Jurassic from Boulogne to Caen; another of ten days for the comparative study, from the standpoint of physical geography as well as of geology, of the three great volcanic regions of the massive of central France. The complete chronology of eruptions from the Miocene up to the end of the Quaternary will be displayed, and the excursion will then be continued through the Causses of the Lozère, and the gorge of the Tarn to the mountain of Aigoual. Nineteen special excursions are proposed, varying in length from four to twelve days. They and the special object of each are as follows: To the Ardennes for the stratigraphic study of the Cambrian and the Devonian; to Picardy for Cretaceous phosphates and Quaternary clays; to Brittany to see the metamorphism of fossiliferous paleozoic strata under the influence of intrusive granites; to Mayenne for the study of the section of the basin of Laval and the crystalline rocks of the Coëvrons; to the Cher and the Sarthe valleys for Upper Cretaceous strata; to Pont Levoy and Manthelon, to visit the celebrated fossiliferous localities of the shell marls of Touraine; to the Liassic and Permian regions of Morvan, with their associated eruptive rocks; to the coal mines of Commentry and Decazeville; to the massive of Mont Dore and the chain of the Puys and Limagne, for the study of the volcanic craters in the vicinity of Clermont, the succession of eruptions of Mont Dore, and the peperites, basalts, and phonolites of the Limagne; to the Jurassic terrain of the Charentes, with its varied facies of cephalopods, oolites, and coral reef, and the Cretaceous cliffs with their rudistids; to the basin of Bordeaux, where a section from the beds of the Middle Eocene to the Miocene is to be studied; to several Tertiary basins of the Rhone, and Mesozoic and Tertiary areas of the Lower Alps; to the Alps of the Dauphiny and Mont Blanc for the study of folds; to the High Alps near Mont Pelvoux to examine metamorphic schists and gneiss, granite massives with syenites, diabases and lamprophyres, coal with eruptions of orthophyres, other sedimentary and eruptive rocks, and numbers of tectonic problems; to Mont Ventoux and Mont Lure for overthrusts and unconformities among Upper Cretaceous, Eocene, and Oligocene strata, and for fluvio-glacial terraces; to Lower Provence for lacustrine Cretaceous and other formations; to the region of the Montagne Noire, where fossiliferous and metamorphosed paleozoic strata, and fossil-bearing lower Jurassic and Tertiary beds are to be studied; and, finally, two excursions to the Pyrenees, one of which will be for the purpose of studying the eruptive rocks near Lake Lherz and the granites and their contact phenomena in the upper valley of the Oriège, and the other to examine the sedimentary areas of Corbières, Haute Garonne, Lourdes, etc., comprising Jurassic, Cretaceous, and Eocene rocks, giving numerous fossiliferous exposures, including the nummulitic beds. Later in the year another circular will be issued giving more detailed information about the excursions and membership in them.

A NEW POWER IN PHOTOGRAPHY.

Just when to stop the development of the photographic negative on a gelatino-bromide plate has always been more or less of a problem even to the expert; and as over is more easily corrected than under development, it has been the practice, when in doubt, to carry it beyond what was known to be necessary, trusting to reduction to bring the image back to the required density.

For this purpose various methods or reducing agents have been employed, but hitherto they have all had one fault in common—the altering of the values, tonality, or gradation, the most important feature of a negative. This they do in consequence of the fact, hitherto supposed to be unalterable, that reduction goes on equally all over the plate, as much being removed from the delicate detail, in what will be the shadows, as from the denser deposit of the half-lights and lights, resulting in negatives that give prints of the white and black or "soot and whitewash" variety.

Recently, however, the brothers Lumière, to whom photography is already much indebted, have given to photographers a new power in the shape of ammonium persulphate, a solution of which has the property of attacking only, or at least first, the higher and half lights without touching the weaker deposits in the shadows, thus enabling them to reduce contrasts and secure such values or gradation as they may desire.

It will be evident that with one of the older reducing agents that reduce equally all over the plate, and the new agent which acts only on the denser parts of the image, the photographer may with confidence develop to any degree of opacity, knowing that he has the power, by reduction, to produce any degree of gradation that he may desire.

Hardly less of a problem, especially to beginners, has been how to secure correct exposure; and, according to at least one expert, the solution is to be found in ammonium persulphate. It is well known that overexposure tends to flatness. The negatives may have all necessary detail, but the lights and half-lights are so translucent as to give only weak, flat prints. If, however, ammonium persulphate in conjunction with a bromide be added to the ordinary developing solution, any degree of contrast may be obtained, even to simple white and black, the degree being in proportion to the quantity of persulphate added. For this purpose W. B. Bolton recommends a solution of ammonium persulphate 25 grains and ammonium bromide 5 grains in one ounce of water, and a few drops added to the developer. The action will be slower, and the degree of contrast greater, in proportion to the quantity of solution added; but a few experiments will show just what that quantity should be for any reasonable amount of over-exposure.

It may be well to add that the new reducer is not the acid or hydrogen-sulphate, NH_4HSO_4, sometimes called the persulphate, but the true persulphate, NH_4SO_4, said to be produced by electrolysis from the hydrogen-sulphate, thus $NH_4HSO_4 = NH_4SO_4 + H$, the atom of hydrogen being eliminated and the persalt formed at the negative electrode.

COLONIES OF THE WORLD.

"The Colonies, Protectorates, and Dependencies of the World, their Area, Population, Revenues, and Commerce, and the Share of the Mother Country in their Commerce," is the title of a publication just issued by the Treasury Bureau of Statistics. The colonies, protectorates, and dependencies of the world number 126. They occupy two-fifths of the land surface of the globe, and their population is one-third of the entire people of the earth. Their total imports average $1,500,000,000 worth of goods annually, and of this vast sum more than 40 per cent is purchased from the respective mother countries. Of their exports, which considerably exceed their imports, 40 per cent go to the respective mother countries. Large sums are annually expended in the construction of roads, canals, railways, telegraphs, postal service, schools, etc., but in most cases the present annual expenditures are produced by local revenues or are represented by local obligations. The revenues of the British colonies in 1897 were £151,000,000, and their expenditures £149,000,000. While the public debt in the more important and active of these communities aggregates a large sum, it is represented by canals, railways, public highways, harbors, irrigation and other public improvements intended to stimulate commerce and production, the railways in operation in the British colonies alone aggregating 55,000 miles.

Of the 126 colonies, protectorates, dependencies, and "spheres of influence" which make up the total list, two-fifths belong to Great Britain, their area (including the native feudatory states of India) being one-half of the grand total of colonial territory, and their population considerably more than one-half the grand total of colonial population. France is next in order in number, area, and population of colonies, etc., though the area controlled by France is but about one-third that of Great Britain, and the population of her colonies less than one-sixth of those of Great Britain. Commerce between the successful colonies and their mother countries is in nearly all cases placed upon practically the same basis as that with other countries, goods from the home countries receiving in the vast majority of cases no advantages over those from other countries in import duties and other exactions of this character. In the more prosperous and progressive colonies the percentage of importations from the mother countries grows somewhat less as the business and prosperity increase. The chief British colonies in North America (Canada and Newfoundland), which in 1871 took 50 per cent of their importations from the home country, took in 1896 less than 30 per cent from Great Britain; those of South Africa (Cape Colony and Natal), which in 1871 took 83 per cent from the home country, took but 71 per cent in 1896; those of Australia and the adjacent islands, which in 1876 took 48 per cent from the home country, in 1896 took but 40 per cent. The French colonies now take from the home country about 42 per cent of their total imports, while the British colonies obtain about 40 per cent of their total imports from the home country. The tables show:

1. The colonies, protectorates, dependencies and "spheres of influence" of various countries of the world having possessions of this character, with area, population and number of colonies in each case.

2. The British colonies, protectorates, dependencies, etc., with area, population, revenue, expenditure, indebtedness, shipping and railways, also the imports and exports and the share of the home government therein.

3. The commerce of the British colonies and the share of the United Kingdom therein, at twenty-five one-year intervals from 1871 to 1896.

4. French colonies, protectorates and dependencies, showing their area, population, location and date of acquisition.

5. Commerce of the principal French colonies, with the share of France in the same at the latest attainable dates.

6. The German colonies, protectorates, and dependencies, with area, population, location, date of acquisition, and form of government.

7. Netherlands colonies and dependencies, showing location, area, population, etc.

8. Portuguese colonies and dependencies, showing area, population, and general location.

9. Colonies, protectorates, dependencies, etc., of other countries, with area, population, etc.

10. Condition of each colony separately stated, showing its location, area, population, revenues, expenditures, imports, exports, and method of government, with additional data regarding roads, telegraphs, railways, and postal service, where practicable.

Colonies, dependencies and protectorates of the world, showing area and population of the colonial possessions, protectorates, dependencies and "sphere of influence" of each country:

Countries.	Number of Colonies.	Area (Sq. Miles.)	Population.
United Kingdom...	48	11,250,412	344,059,122
France.....	32	3,617,327	52,642,930
Germany.....	8	1,020,070	10,600,000
Netherlands	3	802,863	38,911,744
Portugal	9	801,060	9,216,707
Spain.....	3	245,877	256,000
Italy.	2	104,000	650,000
Austria-Hungary....	2	23,262	1,568,092
Denmark	3	86,614	114,229
Russia.....	3	255,550	5,684,000
Turkey.....	4	564,500	17,489,000
China.....	5	2,881,560	16,680,000
United States*.....	4	168,287	10,177,000
Total.....	126	21,821,382	503,048,824

* Subject to ratification of treaty.

Note.—United Kingdom includes Indian Feudatory States; Russia includes Finland.

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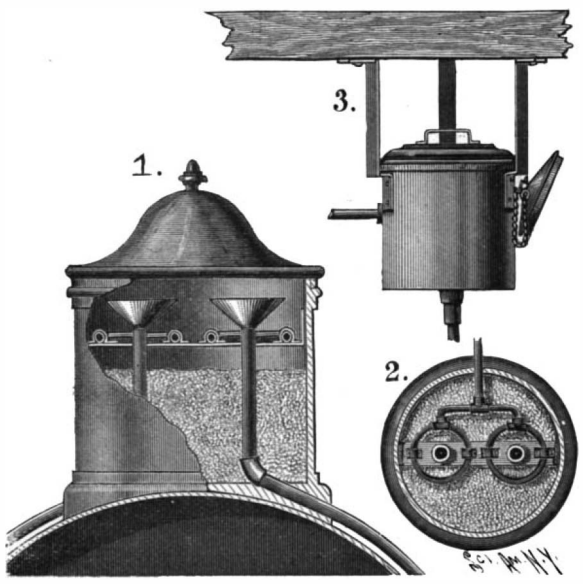
A PNEUMATICALLY OPERATED RAILWAY-SAND-BOX.

The sand-boxes of most railway-trains usually have their bottoms provided with slides, by means of which the sand may be discharged or cut off. Often it happens that a pebble prevents the slide's closing, for which reason the supply of sand will run out. In a device patented by James R. Donley and Halsey B. Philbrick, of Hartford, Conn., this objection is overcome by discharging the sand through the medium of an air-blast.

Fig. 1 is a view of a locomotive sand-box with parts broken away to show the construction. Fig. 2 is a horizontal section of the box shown in Fig. 1. Fig. 3 is a front elevation of the sand-box applied to a car-body. The box, shown in Fig. 1, is designed for use



A PNEUMATIC RAILWAY-SAND-BOX.

upon locomotive engines. From the interior of the box, two discharge-pipes lead, by means of which sand may be conveyed to the track when the air-blast is in operation. To insure the collection of a large quantity of sand by the discharge-pipes, the upper ends of the pipes are provided with funnels. The air-blast pipe, as indicated in Fig. 2, consists of a straight section communicating with two circular sections, each of which surrounds a discharge-pipe. The circular sections are provided with apertures in their under sides, for the escape of air.

When air is forced into the box, the sand will be driven up against the cover, and will be maintained in this position so long as the air is turned on. When the blast is cut off, the sand drops and enters the funnels of the discharge-pipes, and is conducted to the tracks.

The box shown in Fig. 3 is designed for use on railway-cars, and differs from the locomotive-box in having but one discharge-pipe, the air-pipe being in this instance provided with a single, perforated section surrounding the pipe.

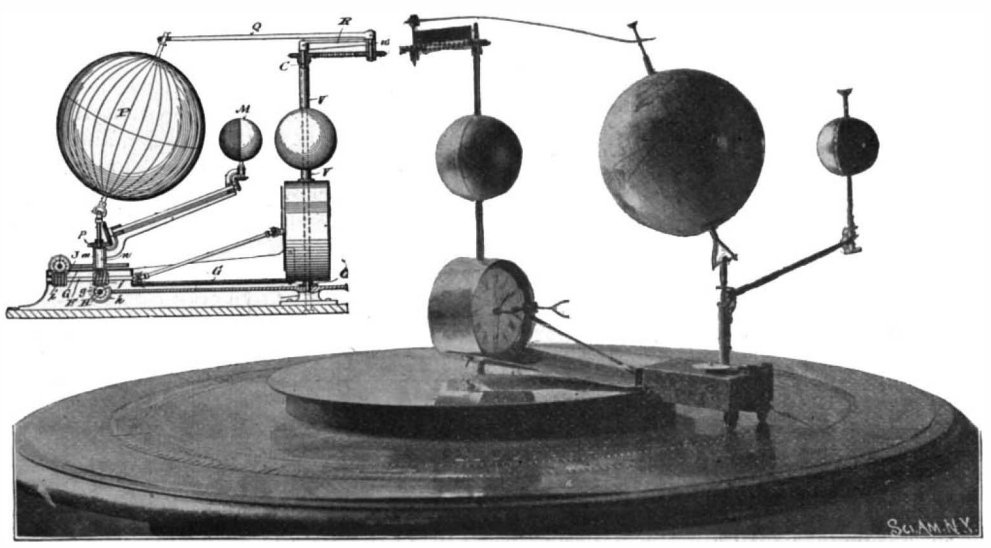
In order to prevent the entrance of sand into the funnel, while the sand-supply is being replenished, an auxiliary cap is provided, which, when not in use, is secured to the outside of the box (Fig. 3). In refilling the box the auxiliary cap is placed over the discharge-funnel, and thus prevents the escape of sand.

AN AUTOMATIC TELLURION.

An ingenious tellurion has been devised by Charles J. Boehm, of 409 Seventh Street, Milwaukee, Wis., by means of which all the phenomena of the earth and moon's revolution about the sun may be represented.

The tellurion is provided with a base upon which are inscribed in concentric circles the signs of the zodiac, the seasons, the months of the year, and the numerical order of days in each month. Upon the base a smaller, stationary, peripherally-toothed plate is mounted, which carries on a pivot-post a globe representing the sun, and a rotary clock constituting a motor for the various coöperating gear-mechanisms. The clock mechanism has universal joint connection with a rod, in turn connected by a universal joint with an arbor, *F*, beneath a plate, *G*. This plate, *G*, is attached to the clock, and is provided with a stationary pointer, traveling over the circle upon which the days of the month are inscribed. A worm, *f*, on the arbor meshes with a worm-pinion, *g*, on an arbor, *H*. A worm, *h*, on the arbor, *H*, meshes with the peripheral teeth of the plate already mentioned, the number of these teeth being twice 365, as there are two revolutions of the pinion, *g*, every twenty-four hours. Another worm, *i*, on the arbor, *F*, drives a worm-wheel, *J*, by means of connecting gear, and the wheel, *J*, rotates a disk upon which the days of the week are inscribed, the position of each day-space relative to a stationary pointer determining the ante or post meridian of that day. The hub, *m*, of the wheel, *J*, is loose on a hollow, vertical stud, *n*. At its upper end the stud carries a bevel-gear, *p*, which rotates the universally adjustable earth-globe, *P*, and the moon-globe, *M*. The earth-globe is maintained at a proper inclination to the plane of its orbit by means of the arm, *Q*, attached to the projecting axis of the earth-globe and by means of the stud, *w*, and arm, *R*. The arm, *Q*, and its stud, *w*, constitute a crank which is driven from the pivot post, *C*, by means of a sprocket-chain geared to a sleeve, *V*, loose on the pivot-post.

In operation, the clock will rotate once in a year, and the pointer on the plate, *G*, will mark the days of each month, the months themselves, the seasons, and signs of the zodiac. At the same time the moon and earth globes will revolve around the sun-globe and rotate on their own axes, the moon's revolution and rotation being accomplished in a lunar month. The clock and coöperating gears can be set forward or back to correct time; or the clock can be dispensed with and the entire apparatus operated by hand.



DIAGRAMMATIC AND PERSPECTIVE VIEWS OF A NEW TELLURION.

An Electrically Operated Stage.

Modern science has entered almost every walk of life, and one of the rarest exceptions which we could name is the stage. With one or two reservations, we can say that in the United States the modern stage does not exist, and with two or three examples in England the same is the case. Germany is the great center of modern stage equipments. The splendid stage at Vienna is marvelous and makes the archaic stages which we use in this country appear actually disgraceful. We have used electricity for almost every purpose, but we have yet to learn of its use in the United States for anything but obtaining "effects," and it has remained for us to learn the lesson from the Drury Lane Theater, London, where a new electrical installation has just been constructed by Mr. Edwin O. Sachs, the well-known theatrical architect and expert, whose important monographs upon theaters and opera houses and stage mechanism are the most valuable contributions which have ever been made to the literature of the subject. With the exception of one great theater, the Auditorium, at Chicago, we do not know of any theater in the United States where manual power is not used in the raising or lowering of the bridges or in shifting the scenes. It may be said that a "bridge" in stage parlance is a section of the theater stage directly in front of the proscenium which can be raised or lowered at will. These sections are usually long and narrow and they can be raised or lowered so as to produce mountains or a deep cave, when masked with the appropriate scenery and properties. In the present instance the stage is divided into six bridges which are each 40 feet long and 6 feet 9 inches wide, with an 8 inch flap in between. The electrically operated bridges may be moved vertically to a height of 12 feet above the stage level or 8 feet below it. The two rear sections can only move vertically, but the others can also be moved in a sloping direction to produce certain effects. The third and fourth bridges from the front are still operated hydraulically, so that it will be possible to compare electricity and hydraulics in actual competition. A considerable section of the stage occupied by one of the bridges is carried by two light steel arched latticed girders which are well braced together so as to form a rigid structure. Of course, the weight of the platform and girders is considerable, but they are counterweighted at the side walls of the stage proper and are raised and lowered by the mechanism somewhat similar to that used in sidewalk elevators. At the center of each electrically operated bridge and directly underneath it on the floor of the cellar is an independent 7½ horse power motor which actuates winding drums upon which are wound the steel wire ropes, which pass over guide pulleys and are connected to the legs at the four corners. The speed obtained by working these cables is 16 feet per minute. In the event of a breakage of one of the ropes, safety catches have been provided and gear has been installed so as to make the bridges stationary at certain points. One man at the switchboard could manipulate all of the bridges at once if necessary.

We hope, now that a practical example of the use of electricity in the manipulation of the stage has been effected, that attention will next be devoted to the raising and lowering of the drop scenes and borders. It does not seem possible that, at the close of the nineteenth century, the heavy drop scenes, border lights, and other considerable weights should have to be raised and lowered by manual power, and anyone who may be invited to visit the stage of the Opera House in New York can see men climb to the top of the second fly gallery and catch hold of a group of ropes which control a drop scene, swing off from the gallery and descend, their weight gradually raising the enormous drop scene. Even the great curtains are manipulated by manual power. Of course, in general, the crude appliances are less liable to break down at the critical moment than when complicated machinery is used; at the same time, if machinery is properly installed and inspected, there should be no difficulty on this score.

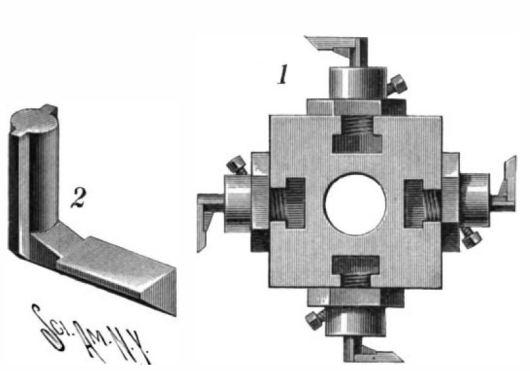
AN IMPROVEMENT IN CUTTER-STOCKS.

A patent was recently granted to Amos W. Terrell, of Patchogue, Long Island, N. Y., for a simple bit-stock which can be conveniently secured to the heads of a machine.

Fig. 1 shows the invention practically applied, and Fig. 2 is a perspective view of a bit used in connection with the stock.

The body of the bit-stock is formed with a foot and with a head, connected by a shank. The shank and the adjacent portion of the head are threaded to receive a jam-nut. A circular bore formed with two longitudinal grooves extends through the body from end to end. In the head a longitudinal slot is made, and opposite the slot the head is provided with a set screw, by means of which the bit is held in place.

Referring to Fig. 2, it will be observed that the bit comprises a blade and a shank extending at right angles to each other. The shank of the bit corresponds in cross-section with the bore, and, after having been



TERRELL'S IMPROVEMENT IN CUTTER-STOCKS.

inserted in the stock, is securely held by the set screw, with the blade extending through the head-slot.

The stock is attached to the cutter-head of the cylinder of the machine by means of the foot and the connecting shank, the cutter-head having suitable openings prepared therein to receive these portions of the stock. When the stock is in position in the cutter-head, the jam-nut is screwed down until it engages with the cylinder, thereby holding the stock firmly in position. It is evident that as the bit wears away, it can be withdrawn from the stock to meet the sweep of the planer-knives of the machine.

Nitrate of Silver Stains.

A solution of iodine in ammonia water, the so-called colorless tincture, will remove nitrate of silver stains from the hands, clothing, etc., but owing to the danger of the formation of nitrogen iodide, which is a very powerful explosive, it is not recommended.

A solution of iodine in iodide of potassium dissolved in water is nearly as quick, and quite as effective. Dissolve fifteen parts of iodide of potassium in fifty parts of water, and to the solution add ten parts of iodine. When the latter is dissolved add sufficient water to make five hundred parts. Keep in a well-stopped bottle. Treat the spots with this, and after a few minutes with a ten per cent solution of caustic soda, which will remove the silver iodide formed by the first treatment.—National Druggist.

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SKATE-SAILING.

The home of skate sailing is Norway, the land of fjords, mountains, and lakes.

In order to sail in the Norwegian fashion, two skates one meter (3·28 feet) long and a sail rigged to a long bamboo pole are required. Long skates are necessary, because the enormous lateral pressure of the wind on the sail would otherwise overturn the skater. The sails are made in all conceivable shapes; almost every sportsman has his own particular form, of the efficiency of which he is firmly convinced. Perhaps the most useful type is the one illustrated in the engraving.

The sail-frame is firmly held by the right hand and is directed by a steering cord held in the left hand. A downward pressure of the right hand forces a steel spur at the end of the bamboo pole into the ice, whereby the skater is enabled either to reduce his speed or to stop himself entirely. The sail is simple in construction, but requires no little dexterity in handling.

Skate-sailing is particularly enjoyable on the great fjords of Norway. On the Sognefjord, for example, 100 kilometers (62 miles) can be covered in a comparatively short time, if the wind be favorable. For our illustration we are indebted to Moderne Kunst.

A NORWEGIAN SKATE-SAILOR.

JAPANESE TORPEDO BOAT DESTROYER.

The accompanying engraving of the new torpedo boat "Ikadsuchi" reminds us of the fact that the Japanese government is very actively at work on the enlargement of its already formidable navy. The photograph was taken by the builders of the vessel, Messrs. Yarrow & Company, of London, at a time when the boat was actually traveling at a speed of over 31 knots, or say about 36 miles per hour, the camera having been used when the "Ikadsuchi" was covering her fastest mile. It will be noticed that she exhibits that tendency to settle at the stern and rise at the bow which characterizes the vessels of this class when they are running at top speed. She is the first of six identical boats which are being built by Yarrow & Company for the Japanese navy.

Her dimensions are: length, 220 feet; beam, 20 feet 6 inches; and draught, 8 feet 6 inches. She is propelled by twin-screw, four-crank, triple-expansion engines, which are balanced on the Yarrow, Schlick, and Tweedy system, which is designed to reduce vibration, and does so very successfully. The high-pressure cylinders are 20½ inches in diameter, the intermediates 31½ inches, and the two low-pressure cylinders 34 inches in diameter, the common stroke being 18 inches. Steam is supplied by four boilers of the Yarrow straight-tube type.

While in general appearance the "Ikadsuchi" is similar to the common type of destroyer, the internal arrangement is modified to the extent that the officers' quarters are placed nearer amidship than is customary in the British destroyers—a modification which will no doubt be highly appreciated by the Japanese officers.

During the trial the contract load of 35 tons was carried, and the high speed of 31 knots was reached without urging the machinery. While the engines were designed for 6,000 horse power, the trial gave evidence that they were capable of a maximum of 7,000 horse power, if it were called for. The steam pressure throughout the trial averaged 185 pounds to the square inch, while the revolutions were 410 per minute. The armament consists of one 3-inch twelve-pounder gun mounted aft and five 6-pounder guns, while two tubes are carried on deck for launching the 18-inch torpedoes carried by this vessel. She stows 90 tons of coal in her bunkers, which is more than sufficient to enable her to cross the Atlantic at cruising speed. It is expected that the official trial trips of these half-dozen vessels will take place during the present year, before the close of which they will probably be on the active list of the Japanese navy.

IT is said that the firm of Kynochs, of Birmingham, England, has begun making 10,000,000 cartridges under an American contract. The cartridges are to be supplied at the rate of 1,000,000 a week.

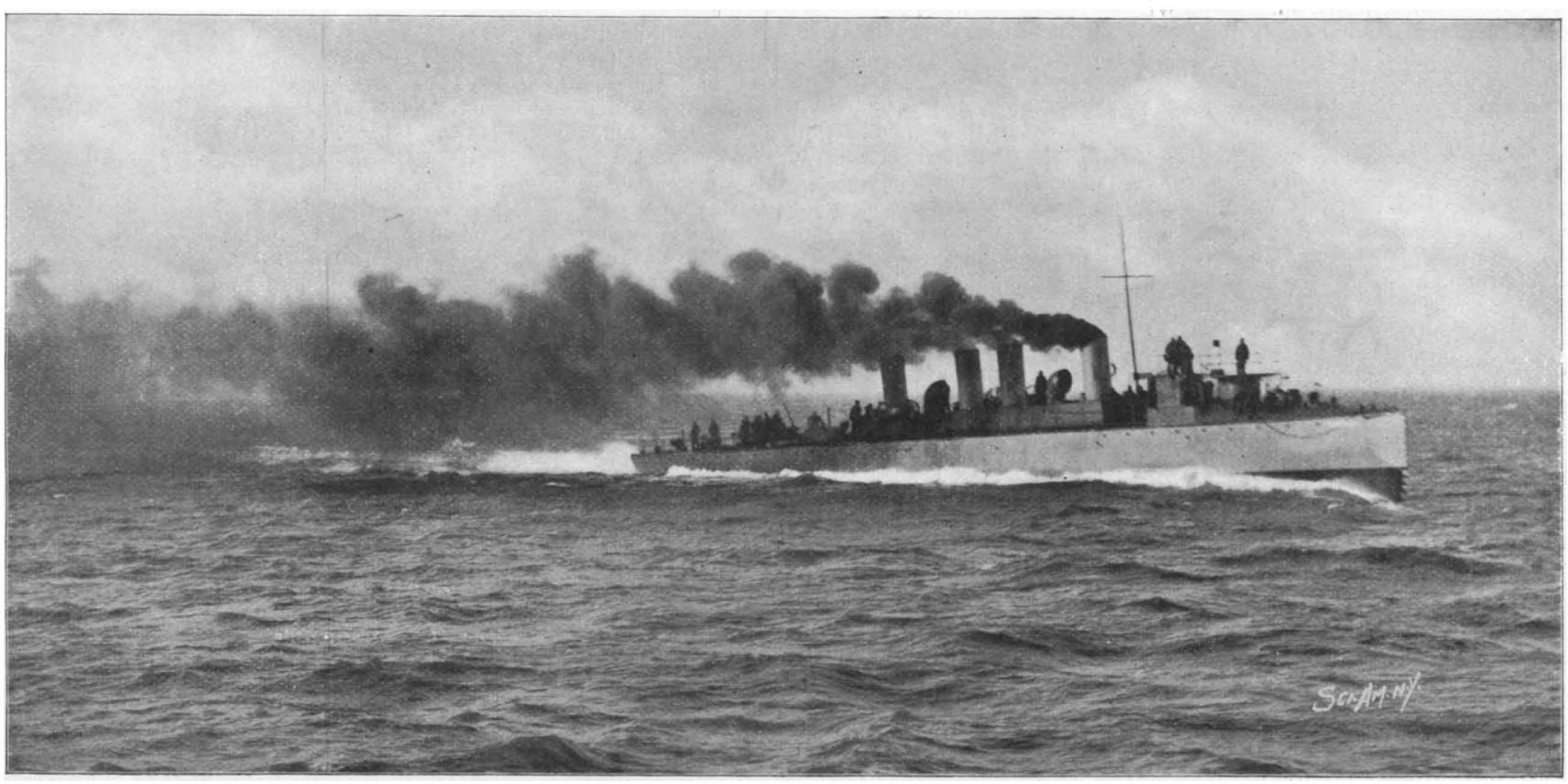
The Shoreditch Refuse Destructor.

The burning of refuse by the Shoreditch Parish, of London, to supply electricity for lighting streets, dwellings, and public buildings has been the food for considerable discussion in the English electrical press. Before the new plant was in operation the parish had to pay about $30,000 a year for carting the refuse to barges on the Thames and towing it to a dumping place in the sea, and about $20,000 annually was spent for gas for lighting the streets and parish buildings. Sixty thousand dollars was expended for an electrical plant. The funds were obtained by taxing the people. The plant ran all the time during week days and twelve hours on Sunday, furnishing electric power for small manufacturers during the day and for illuminating purposes at night. The street sweepings have furnished all the fuel necessary, only $432 being expended for coal. The total expenditures for the first year were $19,070 for wages, supplies, insurance, repairs, etc. The interest, sinking fund, rents, depreciation, etc., was $10,205, making a total of $29,275. The gross receipts for the sale of light and power, including a credit equal to the average charge for street lighting by gas, was $45,205, thus leaving a net profit of $15,930. This will be used in enlarging the plant. Of course, by street sweepings must be understood cinders, manufacturing wastes, etc.

Automobiles in Paris.

Consul-General Gowdy in his annual report states that during the past year there has been a marked increase in the adoption of automobiles, not only as pleasure vehicles owned by private individuals, but in the way of cabs serving the public for hire and for business purposes in the way of delivery wagons, specially those for long distances. It is announced that at the beginning of the next year there are to be one hundred motor cabs driven by electrical power running in the streets of Paris, and if the experiment is successful, the cabs will be increased to one thousand. With this project in view a large plot of ground has been acquired, where the building of works necessary for the housing of cabs and machinery for electrical supply is being rapidly completed. We have already referred to the training ground for cabmen. The automobiles which use petroleum products are objected to by the public by reason of their odor, noise, and vibration.

THE lead keel of the new cup defender was finished January 28, and has been set up on the marine railway where the boat will be built. It is finely polished. The keel is fitted with bronze bolts and as soon as the framework arrives the new boat will begin to take definite form. Two of the bronze plates have arrived, and more are expected the next week. Work has already been started on the sails of the new boat. Later in the season the mainsail will be cut, and the town hall of Bristol, R. I., will be used for the purpose.



THE NEW JAPANESE DESTROYER "IKADSUCHI," MAKING 31 KNOTS ON HER TRIAL TRIP.

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Miscellaneous Notes and Receipts.

New Process of Hardening Steel.—Formerly the hardening of steel was connected with difficulties, inasmuch as cracks appeared in the steel. To obviate this evil, the following process has been adopted, according to Neueste Erfindungen und Erfahrungen: The steel is, as usual, coated with a solution of whiting and varnish, heated to cherry heat, and dipped for a few seconds in acidulated water. Next, it is, for about double the length of time, dipped in rape oil and finally laid in a moderately cooling bath, such as rock oil or water mixed with whiting. By dipping the steel first, for a short time, in water, the heat is drawn away from the outer layer, so that this layer becomes hard. If it were left in the water until completely cooled, the inside core would cool off just as quickly, thus rendering a cracking inevitable. But the fact that the steel is left in the water for a few minutes only, and is then dipped in rape oil, causes a retarding of the cooling in the interior, although the outer layer also loses a little of its original hardness thereby. To restore the latter, the steel is finally placed in a moderately cooling bath. By merely cooling it in oil, it would not attain a sufficient hardness.

To Clean Mirrors.—Take a soft sponge, well washed out and cleaned of all sandy particles, dip it in water, squeeze it out again, then dip it in spirit of wine, rub the glass with it, sprinkle on fine whiting through muslin, and rub the glass again vigorously with a silk cloth. If the mirror is very large, treat only one-half at first, otherwise the spirit of wine dries before it can be rubbed off. If the frame is not varnished, care must be taken that it remains perfectly dry and is not touched with the sponge, because this would injure the gloss or discolor the gilding. The frames can, by the way, be cleaned of dust and dirt without hurting the gilding by rubbing with cotton wool. If they are well varnished, rub them with alcohol. This will remove the stains and produce a nice polish. No cloth should ever be employed for dusting off and cleaning such frames.

The following process, given by Liebhaberkünste, is also conducive to good results: Take pure grain brandy and grind with it on a grinding stone, or if this is not at hand, in a glass mortar, linden or willow ashes which have been filtered through linen until all sandy particles have disappeared; then dilute the ashes with more alcohol and pour it off again after about one hour. With this decanted substance, which contains the finest particles of the ashes, the looking glasses are rubbed down and polished. The mirrors can also be given a handsome luster by rubbing with tin ashes and washing with a piece of soft hat felt.—Allgemeine Tischler Zeitung.

New Process for Producing Polish.—For many years there has been a vain effort, especially in the piano industry, to obviate the ugly exudations of oil on polished articles. The fact that no success has been attained so far is explained by the circumstance that the erroneous opinion was clung to that the oil employed in polishing was causing the eruption. Latterly it has been found out that this effiorescence is due to the vegetable wax contained in large quantities in the shellac. This vegetable wax enters into an intimate combination with the oil in polishing and forms a soft, greasy substance which prevents the polish from hardening properly; it is, therefore, very sensitive to change of temperature, as well as shock and friction. The said soft, greasy mass exudes, after a shorter or longer term, as an oily effiorescence.

The evil, therefore, can only be fully obviated by abstracting from the shellac used for polishing the entire amount of vegetable wax contained therein.

According to a German process, this is accomplished by agitating a strong alcoholic shellac solution with fresh stick lac or seed lac or filtering on this lac. Thereby the readily soluble resin, as well as slight quantities of coloring matter contained in the fresh lac, are abstracted from it, while the more slight soluble vegetable wax is separated from the solution. By one or repeated treatments of the concentrated shellac solution with fresh seed lac a clear alcoholic solution free from wax of the shellac resins is obtained, which is not practicable by simultaneously dissolving the shellac and seed lac in a quantity of alcohol sufficient for a complete solution. (Compare Ande's "Die Technischen Vollendungsarbeiten der Holzindustrie," second edition, 1888, page 168.)

Such a shellac resin solution freed from vegetable wax has heretofore not been employed as a furniture polish and would not be suitable for this purpose, as it is too "short" and not pliant enough to admit of being readily and uniformly rubbed into the wood.

For obviating this difficulty, a medium is added to the shellac solution separated from the vegetable wax which fully takes the place of the wax as regards pliancy and polishing qualities without exhibiting its unfavorable after-effects.

Such a medium has been found in the essential oils, especially in oil of rosemary.

The production of the new polish is, for instance, as follows: Dissolve 20 kilos of shellac and 4 kilos of gum benzoin in as little spirit (95 to 96 per cent) as possible, with addition of 1 kilo of oil of rosemary. The concentrated solution obtained is now repeatedly filtered over fresh stick lac until the vegetable wax contained in the solution is completely abstracted and the solution has become entirely clear.—Färben Zeitung.

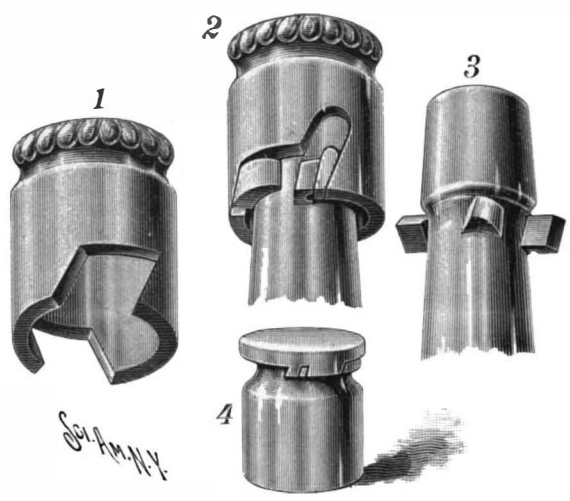
A NON-REFILLABLE BOTTLE.

An improved bottle and jar closure has been invented by Alfred Braverman, Fresno, Cal., which is designed to prevent the adulteration of the liquid contained in a vessel or the refilling of a bottle.

Fig. 1 is a perspective view of a cap employed; Fig. 2 represents a modified form of the cap applied to a bottle; Fig. 3 is a perspective view of the neck of a bottle, and Fig. 4 shows the invention applied to a jar.

The closure as illustrated in Fig. 1 consists of a cap having diametrically opposite, depending, segmental portions. Extending outwardly from the neck of the bottle and diametrically opposite each other, are sealing-lugs and stop-lugs (Fig. 3). One end wall of each of the depending portions is designed to engage with a sealing-lug and the other end wall with a stop-lug. The stop-lug prevents the cap from rotating while the sealing-material is drying. In the construction shown in Fig. 2, a wedge of glass is employed, which is forced between a sealing-lug and the adjacent wall of the depending portion of the closure. To facilitate the entrance of the wedge, the closure is provided with an upwardly extending opening.

The bottle, after having been filled, is corked in the usual way. A cement is then applied to the surface of the sealing-lugs and the cap placed over the bottle-neck. In the modification shown in Fig. 2 the wedge is coated on both sides with cement and is then inserted. After the cement has hardened, the bottle can be opened only by rotating the cap toward the sealing-lugs and away from the stop-lugs. This operation will break the sealing-lugs away from the bottle-neck, leaving but a very slight and narrow projection, which will not cut the fingers.



BRAVERMAN'S NON-REFILLABLE BOTTLE.

The Sanitation of Public Places of Amusement and Churches.

The hygienic arrangement of theaters and other places of amusement all the world over is disgracefully neglected, says an editorial in The Medical Record. The importance of thorough sanitation of schools and similar institutions is now fully realized, and no expense and trouble is grudged in carefully looking after the bodily as well as the mental welfare of the young. It is, therefore, curious that, while adults are so solicitous for a state of sanitary soundness in schools, they should exhibit a complete indifference toward hygienic matters in theaters, music halls, and churches. One reason for this apparent disregard for the laws of health is that the stay in such places is necessarily brief. Nevertheless there are signs that the general public are becoming more alive to the dangers lurking in theaters and churches. The less said about the toilet rooms of theaters, both for the use of the public and employés, the better. The ventilation of public places has received very elaborate attention in some places, but in the older theaters and churches the means for ventilating them are either non-existent or antiquated. So long as playgoers are indifferent, the managers and theater owners will allow matters to remain in statu quo. Theater proprietors are not the only sinners in this respect, for churches of all denominations are in many instances overcrowded and insufficiently ventilated. In churches where services are held at frequent intervals, special means should be taken to provide a sufficient allowance of pure air by mechanical process for ventilation.

A SPECIAL flag for the Coast and Geodetic Survey vessels was used for the first time in launching the "Pathfinder," at Elizabethport, on December 7, 1898. The flag has a blue field carrying a white circle with a red triangle in it.

Science Notes.

S. H. Cavendish, explorer, and Edward Dodson, the naturalist, have gone to Patagonia to search for the giant ground sloth, or megatherium.

Some of the principal carbon interests in the United States will shortly be consolidated in a new organization to be known as the National Carbon Company, with a capitalization of $10,000,000.

The achievements of the American inventor Mr. Eddy are rivaled by the automatic photograph apparatus which has been used for balloon ascensions with such satisfactory results by L. Grilletet, who has been working under the financial encouragement of Prince Albert of Monaco.

Prof. Moissan states, in the Comptes Rendus, that when calcium carbide is perfectly pure, in which condition he has recently prepared it by reducing pure calcium hydride in a bed of pure amorphous carbon, it is quite white and forms white scales which are seen to be transparent when viewed through a lens. The presence of the least trace of iron is sufficient to color them. The brownish color of the commercial calcium carbide is due to the presence of this metal.

It is announced that the cupola of the great church of Sacre Cœur, at Montmartre, Paris, will be completed by the year 1900. Two-thirds of the work is now finished and the summit of the cupola will be reached some time this year. The dome will be surmounted by a stone cross. Five or six months will be spent on the interior decoration of the church after the scaffolding has been removed. The church is very dark at present, but will be properly lighted as soon as the glass is put in the dome. The campanile, the sacristy, and the presbytery will still require about three years' work. The work was commenced in June, 1875, and has cost about $5,000.000 to date; its completion will require another $1,000,000.

A curious method of replacing the roof of a stand pipe was resorted to by the Waterworks Department at Napoleon, O. In a violent wind storm the roof was blown off, together with the upper part of the ladder leading to the top. The water was withdrawn from the stand pipe, and a raft was built inside; then the water was turned on and the raft, laden with workmen and their utensils, was gradually sent upward at the rate of twenty-five feet per hour. It required five hours to make the ascent. Hooks and pulleys were then attached to the pipe, and material was drawn up on the outside, while the men performed their work, using the raft for a platform. A raft has been used before in constructing such things as large water tanks.

Great improvements are projected in Florence which, if they are carried out, will assist to ruin this beautiful city for American and English visitors, who care for it only for its collections and its associations. Some of the last demolitions have aroused widespread anxiety in both England and America, and the result has been that a petition has been circulated by a society which has been organized to defend the Florentine monuments. The project has undoubtedly been downed for the time being, as the petition contained the signatures of officers of all of the art societies in America and England, nearly all of the college presidents and faculties, art writers, and those generally interested in the preservation of things Italian. It seems strange that the municipality of Florence should be so dead to their own interests that it is necessary to work through the cupidity of the hotelkeepers and shopkeepers of Florence, but this is the case. Of course, the old cry of sanitary reasons is advanced, but not on very good grounds.

In Calcutta, India, where an extensive system of sewers are being built, collapsible centers are being used. They are of various sizes, but all are constructed in the same manner. In brief, they consist of a central shaft, having a right-hand screw thread cut upon it from one end to the center and a left-hand thread from the other end to the center. Hand wheels are mounted upon the ends. The screw is mounted upon a framing, which also supports four broad rollers used in shifting the position of the apparatus. On the screw are several nuts provided with vertical arms and with two vertical and two horizontal arms. The outer ends of the upper and lower arms are hinged to channel irons, each pair forming a toggle, with the nuts forming the center. This arrangement allows of the channels being forced apart or closed up like a parallel ruler, according as the central screw is turned one way or the other. Hinged to the top channel are two side plates bent to the right curvature and braced with small angle irons. The lower half of the sewer is built of brick concrete in advance of the arch; the center is rolled into place and the hand wheel turned until the channels and side plates are extended to the proper size, and the rollers are lifted free of the bottom. The arch is then built in the usual way. When sufficiently set, the center is contracted by turning the screw in the reverse direction until the center is free and the rollers are in contact with the bottom. It is then run forward to the next section. The advantages of such a system are self-evident.

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THE FORTIFICATIONS OF OLD MANILA.

BY OUR MANILA CORRESPONDENT.

Perhaps the first and most abiding impression upon entering old Manila is that of the strange commingling of the old and the new. As one approaches the massive walls, and before a near enough view can be obtained to distinguish the strangely assorted artillery that points threateningly over parapet or through embrasure, the impression is altogether picturesque and romantic. One conjures up the days of doublet and hose, hauberk and halberd, and half expects to find the doughty Spaniard of the age of Philip and "good Queen Bess," keeping guard upon the broad stretch of the ramparts, or doing sentinel duty at the entrance gates. For those frowning walls have looked out upon river and bay for thrice one hundred years, and in the age when they were being laboriously constructed the monks of the eastern hemisphere were yet busy putting the finishing touches to the glorious cathedrals of the old world. And right well did they build these old walls of Manila; for it is certain that masonry which stood up so well against the terrific impact of our nineteenth century projectiles must have been more than impregnable against the feeble assaults of medieval artillery.

On a near approach, however, the pleasing illusion is dispelled; for the sight of modern high powered weapons from the famous Krupp factory, and the wicked gleam of machine and rapid-fire guns, bring one rudely back from the romance of medieval times to the stern realities of our nineteenth century civilization.

Old and new Manila are separated by the Pasig River. The old town is entirely surrounded by a wall of masonry which is everywhere from 20 to 25 feet in height and of extraordinary thickness, varying, in fact, from 30 to 100 feet. On the side of the town facing the bay the wall extends parallel with the shore for nearly a mile. At the mouth of the Pasig River it turns sharply inshore, following the course of the river for about half a mile. It then turns and swings back to a junction with the walls on the water-front, this intervening section between the river and the bay being in the form of a semi-octagon, and serving to protect the town from attack by land. The whole circuit of the wall is thus seen to be about three miles.

Entrance to the town is had through a series of massive and extremely interesting old gates, some of which are still complete with drawbridge, chains, and hoisting machinery. They are eight in number, and while they have a general similarity, each has its own points of interest for the antiquary. Between the bay and the seaward stretch of the walls runs the Metelle—a boulevard of considerable note. Leading out to the Metelle are two gates, Puerta Portigo, located near the river, and close down to the great arsenal now occupied by our troops, and Puerta Sta. Lucia, farther to the west. These gates both date back to the middle of the last century, and both have drawbridges and encompassing moats.

On the land side, looking out toward the old Spanish barracks, is Puerta Real and farther toward the Pasig is Puerta del Parian. These two gates are almost facsimiles of each other. Each has outer gates and outer moats and fortifications. While both of them date back to early in the eighteenth century, they have been remodeled and rededicated at a much more recent date. The Del Parian gate contains some fine sculpture and bears the date of 1783, while the Puerta Real was remodeled and dedicated anew three years earlier. Both structures front on the Cascada Aquada, the fine highway which skirts the fortifications from the river to the bay. Beyond the Puenta de Espana this highway is known as the Avenue de la Magellanes, and it runs parallel with the Pasig to a point where the walls extend to the water's edge.

The walls of the old city are in perfect condition, despite their great age. They are, perhaps, the stronger on the bay side, and there the guns are thickly planted. Overlooking the entrance to the Pasig the old walls are also very formidable, and on the land side there are many outer walls and defenses. They are constructed of solid masonry, and, unless they should be torn down, they will undoubtedly remain for centuries to come. The ancient moats, gates, and drawbridges, the parapets, ramparts, and gabionades, the portcullises and other constructions known to the military engineer of the days of Alva and Cortez, may be studied here in their full completeness.

Within the old walls is a succession of magazines and prisons. Here is located the prison of the famous inquisition, that horror of horrors, the "Dark Hole of Manila," where thousands of unfortunates have met their doom, or have been confined only to be led out to execution in the presence of the applauding thousands; out beyond the walls on the bloody La Lunetta.

On the walls of old Manila there are guns of all ages, patterns, and calibers, from the old sixteenth century brass gun to the modern machine and rapid-fire gun. In front of the walls and covering the bay are the great Krupp guns, which could have done considerable damage to our fleet at the time of the bombardment of the city, but which all along maintained a discreet silence. These great guns are four in number, and back on the walls, below the Puerta Sta. Lucia, are two more of the same type but of a smaller caliber. Every gate of the old city was protected by guns of a modern pattern, assisted by others of a doubtful age. Along the bay there are dozens of muzzle loaders of all shapes and sizes, and the river was commanded by strong batteries. Many of the modern guns have been dismounted and are now stored away in the great arsenal; but the old guns still poke their noses from the walls and try to look dangerous. They are indeed an interesting study, and here one can get an idea of the great advances along the line of artillery made during the last three centuries.

The great arsenal located within the walls and close to the point is a most interesting place. Here are extensive magazines in which are stored hundreds of tons of powder and great quantities of munitions of war; for it must be remembered that the Spanish garrison of Manila were in no danger of an exhaustion of military stores. One sees dismounted guns by the dozens and many thousand stands of small arms. One of the most interesting things to be seen here is a modern machine gun, the invention of a Spanish artillery officer, which was constructed in the arsenal shops. It was used to pump projectiles into our lines at Malate, and it proved a model of its kind. Our experts are now studying its mechanism, which involves some novel ideas, and as a result we may have a new terror of warfare. Long lines of projectiles line the yards of the arsenal. Our artisans are now at work here turning out supplies for our army and navy. Old Manila itself is a curious old place built on a strictly Asiatic plan. Besides the fortifications and churches and public buildings, which form the principal part of the old city, there are queer Asiatic houses, with the upper stories projecting out over the narrow streets. The latter, be it said, are so narrow that they would not make decent alleys in an American city. While new Manila, just across the Pasig, is making rapid strides in adopting our American ways, the parent city, which has stood sentinel so long between the Pasig and the bay, has seen no change. It is still the same curious, sleepy old town, and it bids fair to remain the same for centuries to come.

Since that eventful morning of the first of May, on which the guns of an American fleet woke the echoes of this far-away spot, Manila has been the stage on which many and diverse peoples have played their parts. Our group of illustrations on the front page of this issue tells its own story. Here we see the work of our shells by sea and by land. The first illustration shows two of the Spanish gunboats undergoing repairs upon the slip at Cavite. Two other views show the work of shells and conflagration upon the decks of the Spanish fleet in front of Cavite. The guns are of the 4·7-inch type with which most of Montojo's ships were armed. Equally suggestive are the gaping holes torn in the old fort at Malate. The view of an insurgent battery is specially interesting, for it gives us a near glimpse of the uniform, accoutrements, and artillery of a native race which we may possibly be called upon to beat into submission to our authority. Let us hope we may be spared the necessity of imparting civilization to the Filipinos "by hypodermic injections with 12-inch guns."

As our readers look at the little cut of an insurgent gun and learn that it consists of an inner length of gas-pipe, inclosed with staves of wood which are clamped upon it with bands of iron, 3½ inches wide by 2½ inches thick, they will agree that necessity is still the mother of invention.

The Food and Endurance of Arabian Porters.

Arab carriers bear great loads upon their backs, and go at a trotting pace from 6 A. M. to 6 P. M. During the month of Ramadan, the Koran forbids the taking of food between sunrise and sunset, and this law is said to be held sacred and rarely violated. Not only do these porters continue their arduous physical exertion during the twelve laboring hours of the day without taking any food during that period, but the French inspectors who are in charge of the gangs told our informant that they could work better during the month of the fast than at any other time of the year, because their energy was not needed for digestion. At eventide, these Arabs have a moderate meal of wheatmeal porridge, mixed with large proportions of butter (it is to be had cheap) or olive-oil. Their expenditure for food is not more than six or seven cents a day, and the only luxury which they permit themselves is a cup of very strong black coffee and a cigarette. The idler exists on one cent's worth of bread with a little olive-oil, which he buys for an additional five cents.—The Vegetarian Messenger.

The New York Electrical Exhibition.

During the month of May, 1899, there will be an electrical show in Madison Square Garden. The show will be under the auspices of and in connection with the twenty-second annual convention of the National Electric Light Association.

Correspondence.

On the Freaks of Lightning.

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of the SCIENTIFIC AMERICAN of January 21 your correspondent, I. E. Buford, asks for an explanation of a freak of lightning in which two horses were killed and the rider escaped without serious injury. I beg to submit the following, as in a measure explaining the phenomenon: (1) Electricity passes along the lines of least resistance, and, it being summer, the wet, briny skins of the horses offered a better conducting medium than the clothing of the negro. (2) As was demonstrated during the investigation of the subject of electric execution in New York some years ago, the horse is less resistant to electric discharges than man. BERNARD WOLFF, M.D.

January 21, 1899.

[Our esteemed correspondent would be correct if it were true that a static discharge always takes the line of least resistance. Hertz showed that a discharge of a Leyden jar would jump an air gap instead of following a wire around to the other side of the gap. The air had an enormous resistance, the wire only a fraction of an ohm. In the case of the negro riding a horse, the path of least resistance is not air, horse, earth, but air, negro, horse, earth; since 4 feet of negro's body has less resistance than 4 feet of air through which the lightning passed on its way to the horse. There is no question of the relative resistance of horse and man, since the alternative path to earth was not man or horse, but man and horse or air and horse, and it chose the latter.

Benjamin Franklin, nearly 150 years ago, observed that lightning would leave a heavy rod and take to a fine wire which had many times the resistance. It has also been known to leave a good metallic path and tear around generally through a house, over the gilt of wall paper, even through feather beds, instead of taking the path of least resistance. The more facts one accumulates on this subject, the less one thinks resistance has to do with it and the more one is inclined to say "Don't know" to queries like the above.—ED.]

Kissing the Book.

It is a curious survival of an old custom that witnesses are required to kiss the Bible or Testament when an oath is being administered to them in court. There does not seem to be any reason why a witness should not be allowed to take the oath by laying his hand upon the sacred volume, and learned judges have permitted this to be done. On one occasion, when a woman was subpœnaed as a witness, she produced her own copy of the Gospels to be sworn upon, and her forethought and good sense is to be commended. The custom of kissing the Bible should not be continued, in view of the astonishing amount of evidence which bacteriologists have at their disposal. At a recent meeting of the Board of Magistrates, in New York city, the question of discontinuing the practice of requiring witnesses in police courts to kiss the Bible was discussed, and one of their number had, prior to this time, abolished it in the court where he presides. While the subject was not formally discussed, a number of magistrates spoke upon the matter, and the general opinion seemed to be in favor of doing away with the custom. Magistrate Kudlich said that he would like to see the practice of kissing the Bible altogether abolished, because of the indiscriminate use of the Bible by all sorts of persons, which was very liable to communicate disease by means of the delicate membranes of the lips.

Magistrate Kudlich continued; "I have advised witnesses not to kiss the court Bible since an incident occurred some two years ago. During the examination of the witness it was found that he was suffering from a loathsome, contagious disease and that his lips were ulcerated. I forbade the next witness to kiss the infected book and ordered it to be destroyed."

Magistrate Meade said that educated people usually affirm or kiss their own hands when they hold up the book, which is quite true; but, as far as the people were concerned, he was of the opinion that more truth could be gotten out of them if they kissed the Bible, as they have a terror of future punishment if they give false testimony when so sworn. Magistrate Deuel said that kissing the Bible made no difference with witnesses. Magistrate Simms thought that taking the oath with uplifted hand was far more impressive and solemn. Magistrate Olmstead said that, when the Bible was very dirty, he warned the witness against kissing it. Magistrate Pool has abolished the kissing of the Bible in his court, and is really responsible for the discussion which was raised by his act.

That the magistrates of New York are so kindly disposed toward sanitary reform in the police courts is gratifying, and it is to be hoped that the subject will not be allowed to rest, but will be discussed by the judges of the higher courts.

A RESIDENT of a Minnesota town died recently of obesity. He weighed, at his death, 438 pounds.

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THE WHITE STAR LINER "OCEANIC."

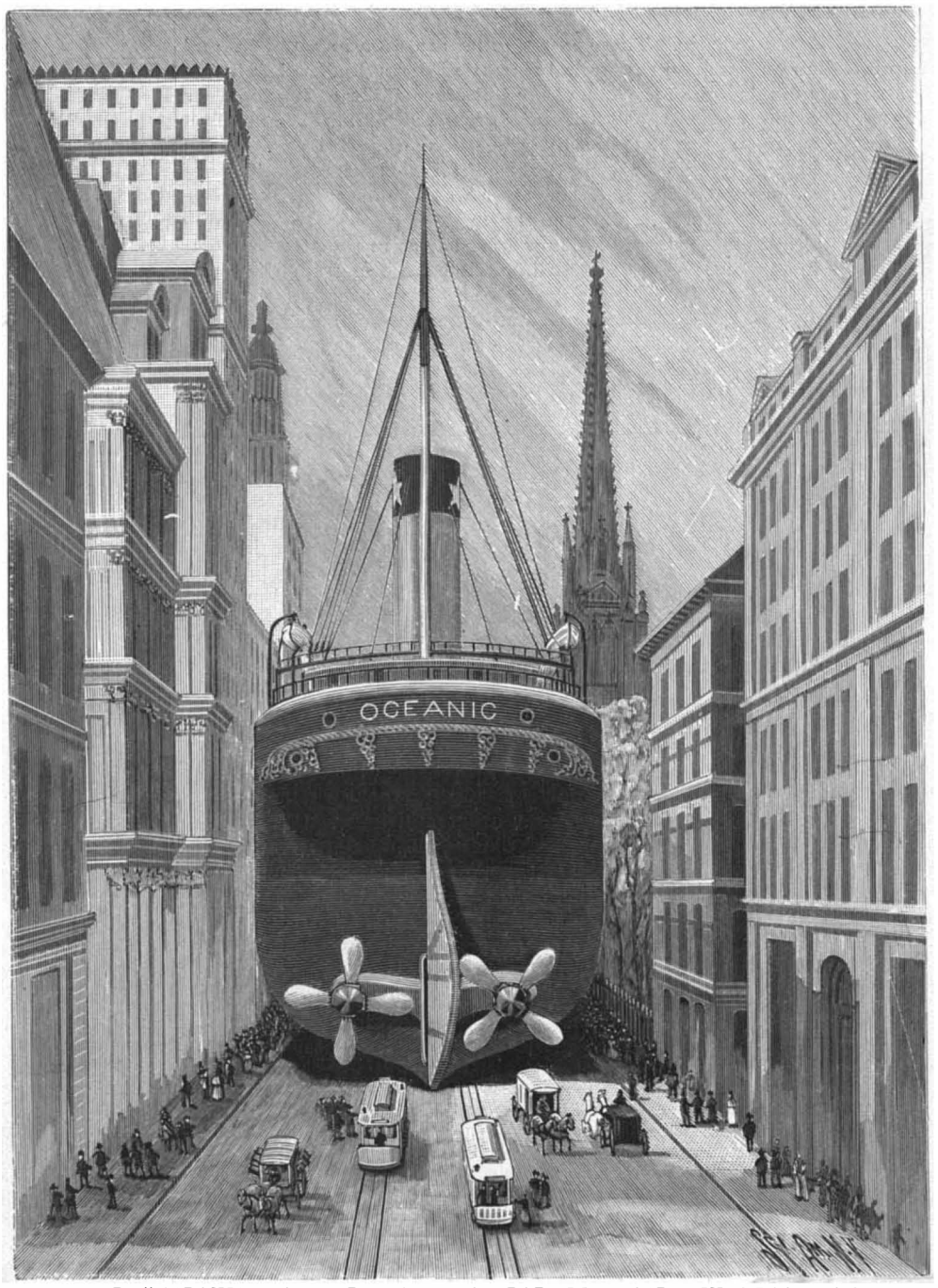
For the future, in stating the size of large ocean steamships, we shall have to adopt a new standard of measurement. It will no longer be the fashion to refer the successive ocean liners as they are turned out of the shipyards to that marine giant of fifty years ago the "Great Eastern;" for at last, after the lapse of nearly half a century, she has been eclipsed by the latest of the modern passenger steamers, the "Oceanic," which recently took the water at the celebrated yard of Harland & Wolff, Belfast, Ireland. The end of the century ship exceeds the "Great Eastern" on all points of comparison, save two. She is longer, draws more water, is of greater displacement, and, of course, greater speed; but in the two respects in which the "Great Eastern" exceeds the "Oceanic" she does so by a very ample margin. The "Great Eastern" was 57½ feet deep, as against 49 feet for the modern ship, and she had 83 feet of beam, as against 68 feet for the "Oceanic"—an excess of no less than 15 feet. As regards the other dimensions, the "Oceanic" is 704 feet long, or 12 feet more than the "Great Eastern;" her draught when fully loaded for sea is 32 feet 6 inches, or 7 feet more than that of the earlier ship. The displacement of the two ships at the given draught is 23,500 tons for the "Oceanic," as against 27,000 tons for the "Great Eastern."

At first sight, on comparing the dimensions of the two ships, it would look as though the displacement of the "Great Eastern" would be larger on account of her great excess of beam, as it is well known that, other things being equal, a slight addition to the beam of a ship makes a large increase in displacement. Indeed, if the draught of the two ships were the same, namely, 32 feet 6 inches,

DIMENSIONS OF THE LARGEST OCEAN STEAMERS.

Name of Ship.	Date.	Length Over All.	Beam.	Depth.	Draught.	Displacement.	Speed.
		Feet	Feet	Feet	Feet	Tons.	Knots
Great Eastern.....	1858	692	83	57½	25½	27,000	12
Paris.....	1858	560	63	42	26½	13,000	20
Teutonic....	1890	585	57½	42	26	12,000	20
St. Paul ..	1895	554	63	42	27	14,000	21
Campania...	1893	625	65	41½	28	19,000	22
Kaiser Wilhelm der Grosse. ..	1897	649	66	43	29	20,000	22·35
Oceanic ...	1899	704	68	49	32½	28,500	20

there would be a considerable excess in favor of the older vessel. At 30 feet draught the displacement of the "Great Eastern" is estimated at 32,160 tons, and, of course, at 32½ feet it would increase proportionately. On the other hand, the lines of the "Great Eastern" were very much finer than those of the Belfast ship. For several hundred feet amidship the section of the latter ship is very full, there being only about 2 feet of rise in the floor and the tumble home being only about 1 foot. This fullness is carried well out toward the stem and stern, and, of course, goes a long way to compensate for the comparatively narrow beam in proportion to length of the "Oceanic." On the other hand, the "Great Eastern," in spite of her enormous beam of 83 feet, does not hold this width for any great length amidship, but commences to fine away toward the ends, and, of course, loses proportionately in bulk.

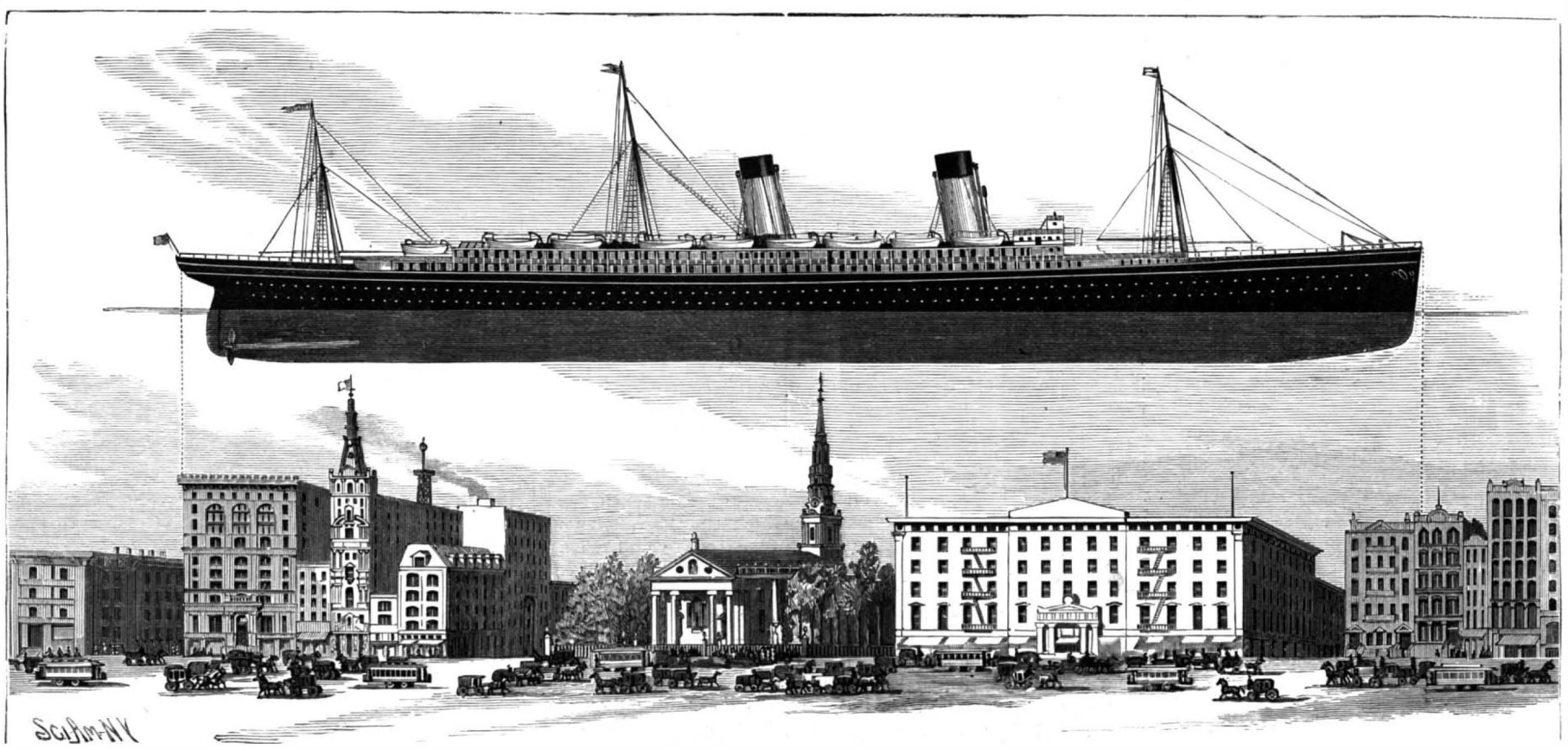


THE "OCEANIC" AS SHE WOULD APPEAR IF PLACED IN BROADWAY AT TRINITY CHURCH.

We are all familiar with the story of the heartbreaking anxiety and early failure which attended the launching of the "Great Eastern." As no ship approaching anywhere near her weight had been sent off the ways before, it was determined to build her parallel with the river and launch her sidewise into the water. The first efforts were a failure, and it was only after three months of labor that the huge mass, weighing about 9,000 tons, was pushed bodily by hydraulic jacks into the river. The launching weight of the "Oceanic" was about 11,000 tons, and the special precautions which had been taken in strengthening the fixed ways at the points subjected to greatest pressure were so successful that the time occupied from the moment she started down the ways to the time when she was brought to rest in the river was a little less than two minutes. The preparation of the ways alone cost about $100,000, and much of the ground over which the vessel passed was completely covered with 1½-inch steel boiler plate. The nearest approach to this launching weight in modern times occurred at the launch of the Japanese battleship "Shikishima," which took place last November at the Thames Iron Works, London. The weight on this occasion was 8,250 tons.

Comparing the "Oceanic" with modern passenger vessels, we find that she is 42 per cent larger than the next largest transatlantic liner, the "Kaiser Wilhelm der Grosse," whose displacement on a draught of 29 feet is 20,000 tons. The next largest vessel is the "Campania," with a displacement of 19,000 tons, and following this come the "St. Paul," of 14,000 tons; the "Paris," of 13,000 tons; and the "Teutonic," whose displacement is given as 12,000.

In respect of horse power and speed, it will be a surprise to many of our readers to learn that the horse power of the big ship will be only 28.000, which is the same as that of the "Kaiser Wilhelm" and 3,000 less than that of the "Campania." The speed, moreover, of the new ship is announced as twenty knots an hour for the whole trip across the Atlantic, which is one knot less than that of the "St. Paul," two knots less than that of the "Campania," and 2·35 knots slower than the best record of the "Kaiser Wilhelm." Moreover, both of the latter boats have maintained an average of about twenty-three knots an hour for an all day's run. Assuming that the White Star Company has no



THE "OCEANIC" COMPARED WITH THE BROADWAY BUILDINGS AT CITY HALL PARK.

Length, 704 feet; beam, 68 feet; depth, 49 feet moulded; 75 feet from keel to captain's bridge; displacement on 32½ feet draught, 28,500 tons.

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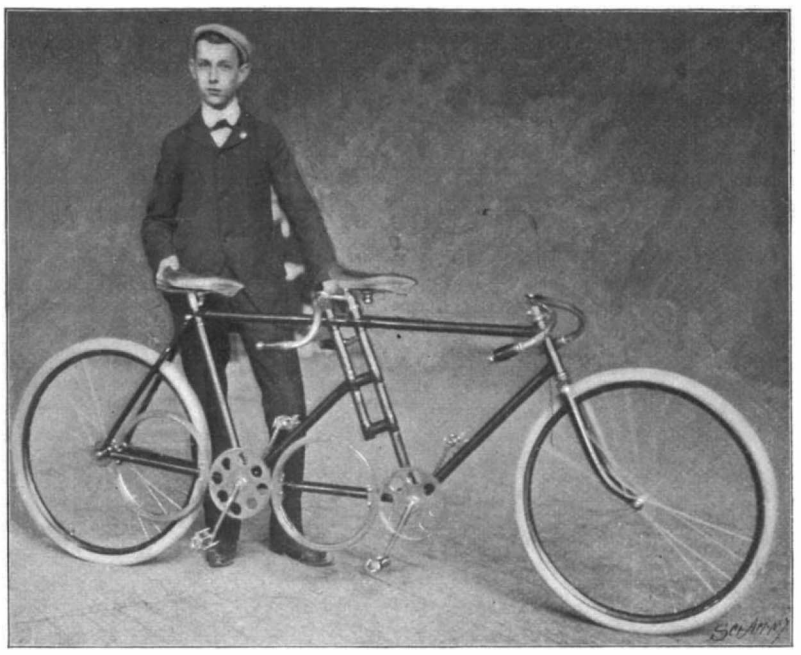
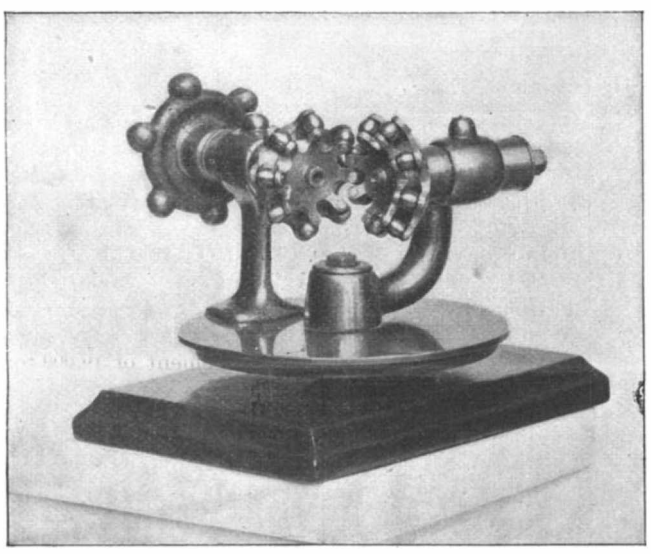
intention of exceeding this speed, it is to be presumed that their determination to withdraw from the record-breaking contest is based upon practical considerations. According to the oft-repeated statement of the company, they consider that there is nothing desirable in the extra two or three knots that may be obtained, beyond the mere prestige which goes with the fastest ship, while, on the other hand, there are positive disadvantages attending this high speed. In the first place, the great increase of weight and the large demand upon space, due to the powerful machinery which must be installed, consumes so much of the ship's capacity as to leave very little room for cargo. Moreover, the consumption of coal is increased by from 30 to 40 per cent, and, of course, the profits of the ship are considerably reduced. Viewed from the standpoint of the passenger, it is claimed that the twelve hours which are saved by putting a ship across the Atlantic at the highest speed frequently only serve to land the passengers in New York Harbor just too late to pass the quarantine, and necessitate their being detained on board until morning. However, in spite of these statements of the company that they intend to run "a regular week boat" instead of a "record-breaker," there are many people in shipping circles who expect the new ship to run very close to, if she does not exceed, the existing records.



CHAINLESS TANDEM.

With regard to the construction of the ship, particular attention has been paid to the element of strength and stiffness. The frames are heavy channels of steel, 9 inches in depth, and they are spaced 31½ inches from center to center. The plating varies in thickness from 1 inch to 1⅛ inches. The plates are generally 4½ feet wide by 28 feet long, and they vary from 2 to 3½ tons in weight. The total number of rivets used throughout the hull was 1,704,000. The double bottom, which is built on the usual cellular system, extends throughout the full length of the ship, and, in general, is 5 feet 1 inch in depth, except beneath the engines, where, in order to comply with navy requirements, the depth is increased to 7 feet, for the purpose of giving the requisite strength.



BULLIS "BALL BEARING" GEAR.

The "Oceanic," it should be said, has been built to meet the Admiralty requirements, and has a sufficient number of gun platforms to carry a powerful rapid-fire battery. As an armed cruiser, she would be of great service, for, with her full supply of coal on board, she could steam around the world at 12 knots speed without recoaling, and, of course, her enormous size would make her an ideal troop ship.

The determination to provide the vessel with great longitudinal strength is shown by the fact that, in addition to the deep inside vertical keel, there are each side of the keel three longitudinal plate girders, worked in between the outer and inner bottoms. Moreover, at the turn of the bilge, the plating is worked in double thickness, and the sheerstrake and the strake next but one below it have been doubled in thickness, while the upper deck stringers have also been doubled for a considerable length amidships.

Great strength is also afforded by the five steel decks, which are completely plated from stem to stern. Including the inside floor of the ship, there are seven distinct decks in all, and above these is the boat deck, which extends for several hundred feet amidship. The captain's bridge is exactly 74 feet 9 inches above the keel, and will be about 40 feet above the water line when the ship is down to her load line. The names of the decks commencing from the bottom are the lower orlop, orlop, lower, middle, upper, promenade deck and boat deck. The engines are of the twin-screw triple-compound, inverted type, working upon four cranks, and the cranks will be set according to the well known Schlick system, which is designed to eliminate vibration and has shown very good results in practice. The high pressure cylinders are 47½ inches, the intermediates 79 inches, and the two low pressure cylinders 93 inches in diameter, the common stroke being 72 inches. The crank shaft is of Whitworth compressed steel and is built up in four lengths. Its diameter is 25 inches; and the diameter of the crank pins is 26 inches. The boilers are of the double-ended return-tube type; they will work under a pressure of 190 pounds to the square inch.

There will be accommodation for 410 first-class passengers, 300 second-class and 1,000 third-class, and as her crew will number 390, the total number of souls on board, when she carries her full complement, will be 2,100.

In conclusion it should be mentioned that this magnificent ship is only one of a large fleet which this great Irish shipbuilding firm has constructed during the last twenty-five years for the White Star Company. In fact, every one of the vessels of the company's fleet has, we believe, been built by Harland & Wolff, and in no single instance have the ships failed to live up to and exceed expectations. The total value of these vessels, including the "Oceanic," amounts to $37,500,000, and it is a remarkable fact that the ships have been built without any hard and fast contract.

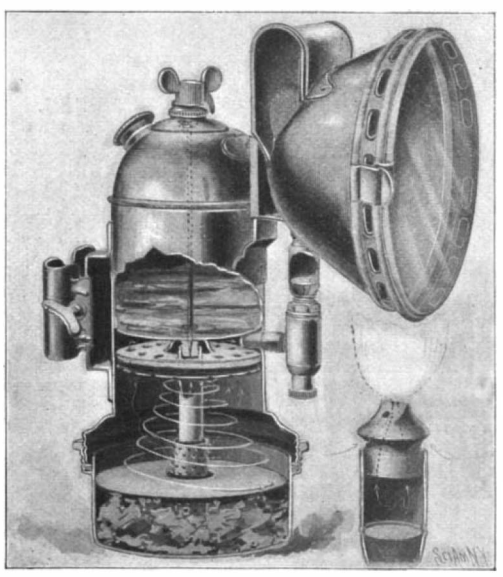
It is probable that the "Oceanic" will make her maiden trip to New York in August or September of this year.

WILFORD HALL CRANKLESS BICYCLE.

NOVELTIES AT THE LATE BICYCLE SHOW.

The most striking feature of the late bicycle show at Madison Square Garden, New York, was the absence of radical novelties in the make-up of the bicycles themselves. It is safe to say that in no interval between two successive exhibitions of the development of the wheel has there been so little actual organic change to record as in the two years' interval between the present show and the last that was held in this city. It really does begin to look as though the finality of which we have been talking for a decade had come at last.

But, although there is little change in the general form of the wheel, there has been steady improvement in its details; the various adjustments of handle-bar, seat-post, pedals, rear wheel, etc., have received considerable attention, and they are more simple and more quickly adjusted than in the earlier machines. The low steering head which was coming into favor two years ago has now become universal, and with it has come the dropped crank hanger, a drop of 2½ to 3½ inches being common. Flush joints continue to be popular, although there are many practical men who consider that for a given weight of material better results can be obtained with the old style. On the score of appearance, however, the flush joint is incomparably superior, and, as reliable results have been secured, it is likely that the flush joint will remain the standard type.



ACETYLENE LAMP, WITH FILTER.

The predicted return to 30-inch wheels (they were the standard size many years ago) has not occurred. There were one or two of this diameter in the exhibits, but they failed to attract much attention. Theoretically there is an advantage in the larger diameter, especially on a rough road or on worn macadam, for the larger wheel spans the hollows and surmounts the obstructions with less shock. We have tested this under exactly similar conditions, by replacing the old 28-inch by 30-inch wheels on a favorite machine on which we had ridden 2,000 miles. The lessened vibration is distinctly noticeable when running over rough surfaces, such as poor macadam or Belgian blocks. There is, however, an increase in weight, and, perhaps, a loss in the trim appearance of the wheel, which will probably prevent any return to the larger wheels.

We are also glad to note that there is a return to reasonable weights, and the presence of eighteen and twenty-pound wheels in the exhibits of a few of the best makers testifies to the truth of our recent contention that a thoroughly reliable wheel could be made at these weights. The reduction of weight has been secured by using the very best material and by cutting out every ounce of it that is not essential to the strength of the wheel. The price of such wheels is usually $75, as against $50 for the heavy machines. This is to be expected, for it takes the very best of work to produce a reliable eighteen-pound wheel. A lovely little wheel of this weight was shown in the Cleveland exhibit.

In our last issue we gave a comprehensive survey of the exhibition, and we now present several cuts showing a few of the novelties which attracted most attention.

The chainless wheel was, of course, the

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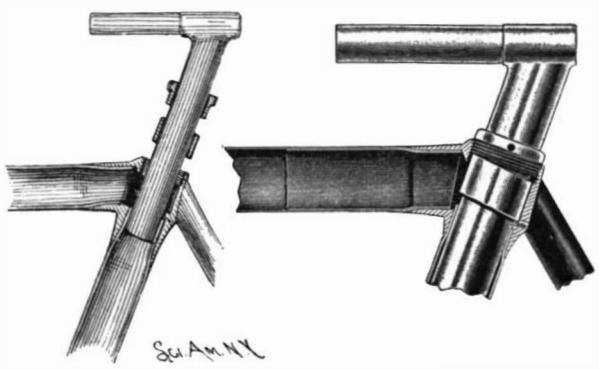
most important feature of novelty (if we can call it novel) in the building. Six types were shown, the Bevel gear, the Sager, the Spin roller, the Spur gear, the Moomy, and the Bullis gear. Of these, the Sager predominated, and next in the number shown came the Bevel, Spin roller, and Bullis types. In the Sager, the power is transmitted through gear wheels with teeth of an entirely novel but theoretically good form, which mesh with wheels provided with pins and rollers in place of the ordinary teeth. The roller gear is of very strong construction, and it is difficult to see how it could get out of order, provided the material is of proper wearing quality. The curious form of the teeth on the gear wheel is obtained by means of a machine which has a revolving head provided with four revolving cutters of the same size and pitch as the roller teeth of the roller gear. The gear wheel and the cutting machine are set up exactly in the relative position they will hold in the bicycle and rotated together, the cutters cutting out a tooth of the exact shape to conform to the path of the rollers. It was on a machine of this type that "Major" Taylor recently made the world's record for the mile of 1 minute 31⅘ seconds.

In the Spin roller gear, as distinguished from the Sager, both of the intermeshing wheels are provided



TRIBUNE SEAT-POST ADJUSTMENT.

with roller teeth journaled on pins, each tooth curving inwardly toward its axis. In this type the principle of roller contact is carried one step further than in the Sager, and theoretically the sliding friction at the point of contact is totally eliminated. The contact is "point" contact, as distinguished from the "line" contact of the Bevel and Sager gears.

The Bullis gear substitutes steel balls rotating on pins for fixed teeth in the earlier form of its gear (see cut), and in the later form it uses balls in one of the intermeshing gears and concave rollers on the other gear, thereby securing a wider path to resist the wear. In the later form the pins on which the balls run are tapered, with a view to enabling a rider to adjust the balls and take up the wear. All of the above types are provided with dust-proof casings. In the Moomy chainless the double ball bearings of each set of gears are placed in one rigid bracket, which holds them absolutely in proper relation to each other By this arrangement the tubes of the frame may be sprung out of line without causing any binding of the gears.

Another type, the possibilities of which have been by no means exhausted, is the Spur gear (shown in

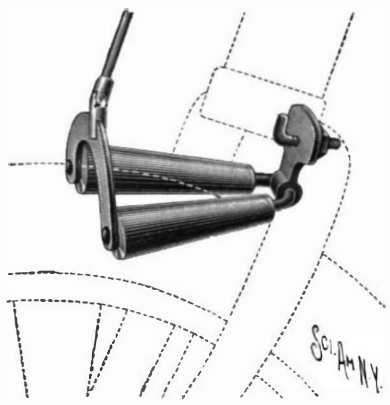
TRIBUNE HANDLE-BAR GRIPPING DEVICE.

the accompanying cut of a chainless tandem), which has never received the attention it merits from the riding public. In the form of Spur gear shown the chain is replaced by intermediate spokeless gear wheels which travel by means of a circle of balls upon large rings bolted to the right lower fork. The whole gear is incased, runs with great smoothness and has a neat appearance.

The chainless is in our opinion the coming wheel. As soon as it has been proved to the public satisfaction that it runs as freely under *all* conditions, and is as durable as the chain, it will sweep the older type from the field—so great are the advantages of an inclosed mud and dust-proof gearing.

Of the wheels which embody new driving mechanisms, we select for illustration the Wilford Hall. In this it will be noticed an attempt is made to get around the supposed mechanical deficiencies of the crank as a means of changing rectilinear into circular motion.

In another, called "the hill climber," the inventor seeks to enable the rider to do more effective work on the down stroke, and to this end he provides two levers, one on each side of the frame, which are pivoted at the bottom of two vertical levers that are themselves pivoted at the upper part of the rear stays of the bicycle. The lower, or propelling, levers have ball-bearing attach-



DUNBAR BRAKE.

ments to the crank-pins at a point a few inches from their (the levers') front ends. The cranks are placed at the forward end of the levers. It is claimed that the crank is practically lengthened to 10 or 12 inches on the down or driving stroke, while the foot only travels in the usual 14-inch circle.

In the Wilford Hall machine the rotary motion is dispensed with by attaching the pedals at the forward ends of two levers which are pivoted at the mid-length of the rear forks. From the levers two lengths of chain pass over loose sprockets, attached to the top of the seat-post tube, and down to jam clutches on the hubs. In the normal position, when not in use, the chains are drawn around the clutches by means of suitable springs, the levers being at the same time in the raised position. When pressure is put upon the

SELF-CLAMPING SEAT-POST.

pedals, the clutches are thrown into engagement and the bicycle is driven forward. The length and the frequency of the stroke can be varied at will, and, as there are no dead centers, it is claimed that this wheel makes an ideal hill climber.

The Dunbar bicycle brake, which is applied to the front wheel tire, consists of two conical rollers which are so placed that their axes diverge (see cut). It is applied to the tire by the usual front brake gear. The object is to reduce risk of puncture, avoid pulling out repair plugs, and to avoid the throwing of dust and mud. It is attached by a simple hook clip, as shown, which takes hold of the inside of the fork crown.

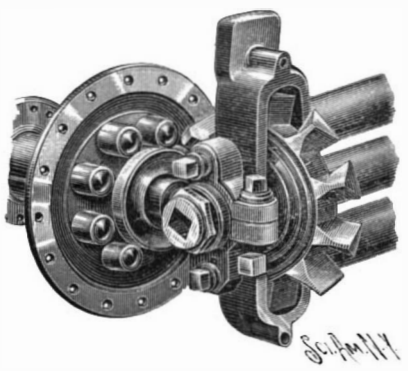
The ingenious and rapidly adjusted split seat-post herewith illustrated will commend itself to those who wish to guard against the bicycle thief. The wedge action of the two halves of the post causes the post to bind firmly within the tube. A sharp upward blow under the front of the saddle releases the wedge, and enables the rider instantly to disable the machine by carrying off the seat with him.

We also show one of the acetylene lamps (their name is legion) exhibited at the show. The carbide, in fragments, is kept at the bottom of the lamp by a coil spring. Water is fed by a needle valve, and the liberated gas passes up through a perforated filter plate before passing to the burner. The latter has two air holes, as shown, formed diagonally on each side of the burner, which causes a current of air to impinge on the base of the flame.

Very neat and effective seat-post and handle-bar clamps are found on the well known Tribune bicycles. The former consists of a beveled ring or collar, which fits closely over the post and catches at its lower edge against a projection within the seat-post forging. The screwing down of a nut on the upper edge of the beveled ring causes the latter to bind against the post. The handle bar is clamped against the inner walls of the steering tube by means of four independent jaws which open outwardly through slots in the tubing of the stem. They are forced outward by an expander which is drawn up and locked by nuts at the center of the handle bar as shown. In this machine flush joints are used throughout. The metal of the joint forging is reamed out and the tube ends are swaged down, without reducing the thickness of the metal, and brazed into the joint. By this means it is claimed that the handsome appearance of the flush joint is secured without any sacrifice of strength.

The Seat of the Soul.

Understanding by "soul" the highest intellectual faculties, it is worth considerable trouble to find out where these functions are located. Savages believe that it is in the liver or the heart; cynics suggest that it is in the stomach; phrenologists place them in the front part of the brain; but the most advanced physiologists, says D. G. Brinton, of the University of Pennsylvania, in Science, are now inclined to teach that the posterior cerebral lobes have the highest in-

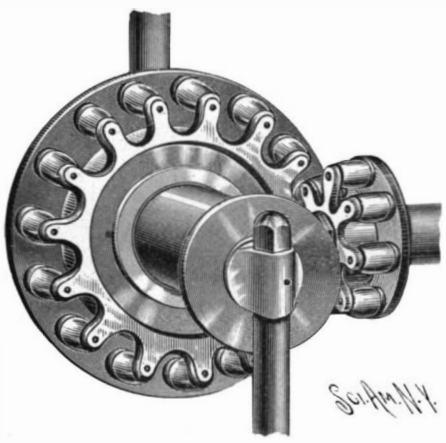


SAGER GEAR.

tellectual value. Dr. C. Clapham's arguments to this effect are quoted with approval in the Centralblatt für Anthropologie (1898, Heft 4). These arguments are that man has the most highly developed posterior lobes, and this is conspicuous in men of marked ability and in the highest races. In idiots the lobes are imperfectly developed, and in chronic dementia these portions of the brain reveal frequent lesions. Numerous authorities are quoted in support of these and allied statements.

Mining Machines Admitted Free.

Russia has decided to permit all machines used in connection with the mining and reduction of gold ores to enter without the payment of duty. According to Stahl und Eisen, the Russian Minister of Finance has prepared a list of machines which, under the new decision, may be imported duty free. The list includes: 1. Machines used in gold-washing, such as pumps, water-pipes, machines for the hydraulic dressing of gold, hydraulic pumps for the treatment of gold-bearing sands. 2. Machinery for the treatment of gold ores, such as apparatus for fusing, for amalgamating, for the extraction of gold by the wet process, all kinds



SPIN ROLLER GEAR.

of furnaces, apparatus for the chlorination of gold, iron casks, and dynamos for the electrolytic separation of gold from cyanide solutions.

Machinery used for mining in general is also admitted free. Among such machinery are included dredgers, drilling machines, transporting apparatus, water pumping machinery, ventilators, and all kinds of mining apparatus.

MRS. ESTHER HERRMANN, who is already well known as a benefactor of scientific institutions, has sent a check for $10.000 to the Council of Scientific Alliances of New York, which is composed of eight scientific institutions. The council has had for some time plans of a building which will cost half a million dollars, and we have already described the prospective building in our SUPPLEMENT. It is hoped Mrs. Herrmann's gift will be the first of many similar donations.

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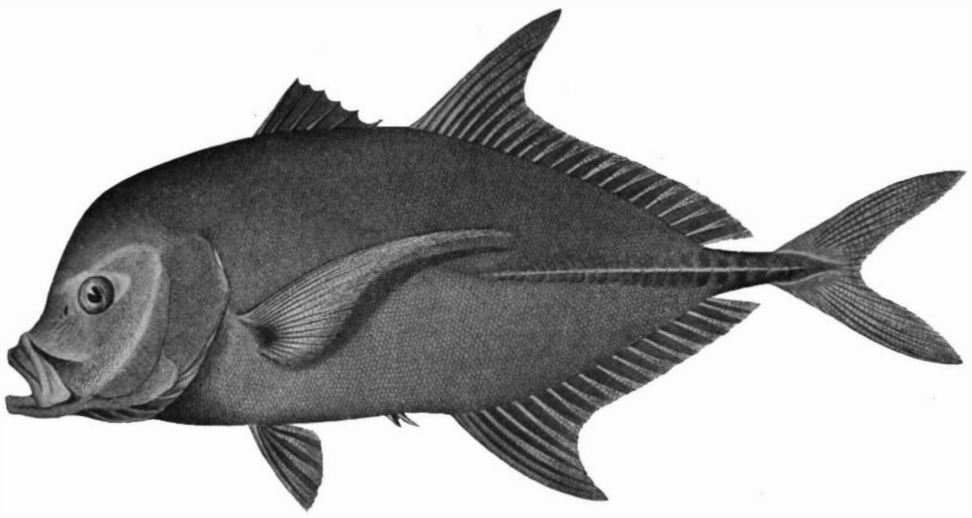
INTERESTING FISH FROM THE ALABAMA COAST.

BY HUGH M. SMITH.

In November, 1898, the United States Fish Commission received from Col. D. E. Huger, a well known business man of Mobile, Ala., a specimen of fish that was not only strange to the local fishermen, but had never before been observed on the United States coast, so far as available records show. The fish had been taken on a line early in November on some snapper banks lying about 20 miles south of Mobile Harbor. The form of the species is so characteristic that its identity is readily discerned, although few students of fishes have ever had an opportunity to examine fresh specimens. It has no vernacular name except a Cuban one, tiñosa; it is, however, a species of crevallé or cavally, of which there are several common representatives along our Atlantic seaboard, and it bears the technical name of Caranx lugubris.

The accompanying drawing, based on the specimen referred to, gives a good idea of the general form of the species. The broad body is much compressed, as in other members of the genus. The large deep head presents a swelling on the median line above and a projecting snout. The mouth is large, and the fish is evidently a voracious feeder. The teeth, while not prominent, are numerous and of varied shapes. In the upper jaw there are two distinct rows, the inner forming a villiform band, while the outer are large and conical; in the lower jaw there is a row of large conical teeth interspersed with smaller ones; furthermore, there are teeth on the tongue, the vomer and the palatine bones. The large eye is provided with a fatty eyelid. Both the second dorsal and the anal fins are falcate, and the pectorals are exceedingly long and sickle-shaped. As to color, the entire body of this fish is a uniform sooty black, the ventral, anal, and dorsal fins being intensely black. The usual length attained by the species is 1½ feet; the Alabama specimen was a little more than 2 feet.



INTERESTING FISH FROM THE ALABAMA COAST.

This fish inhabits chiefly the shores of rocky, tropical islands, and is found on both the east and west coasts of the western hemisphere. In the Pacific Ocean it is recorded from one of the Revillagigedo Islands, lying off Mexico. On the Atlantic coast it has heretofore been observed only about Cuba, but it will probably in time be found near other West Indian islands. Specimens supposed to be this species have occasionally been taken at Ascension Island, in the South Atlantic, and also in the mid-Pacific. The fish taken off Mobile, nearly 500 miles north of Cuba, was evidently a straggler from that island.

Aside from the scientific interest which attaches to the extension of the range of this species to the most northern part of the Gulf of Mexico and so near our own shores, the capture of this specimen has prompted a number of inquiries as to the history and nature of the fish.

It was first recognized as distinct by the late Prof. Felipe Poey, of Havana, and described by him from Cuba, in 1860, although it had been known to ichthyologists for a number of years prior thereto. It is reported to be common about Cuba, and may some time be brought into unpleasant prominence in our new West Indian possessions, on account of the reputed bad qualities of its flesh.

Prof. Poey chose an appropriate name when he designated this species lugubris, meaning mournful, which applies to its somber color, bad reputation, and supposed gastronomic effects. Like a number of other fishes of tropical waters, it is reported to be poisonous, and its sale in Cuba has long been prohibited. A related species, the jurel (Caranx latus), has from time immemorial been excluded from the markets of Cuba, and many disastrous cases of illness have been attributed to its use. Singularly enough, other species of this genus are regarded as excellent food fishes and are extensively eaten in Florida and other Southern States, and one of them, the common crevallé (Caranx hippos), when not too large, is said to equal the pompano for edible purposes.

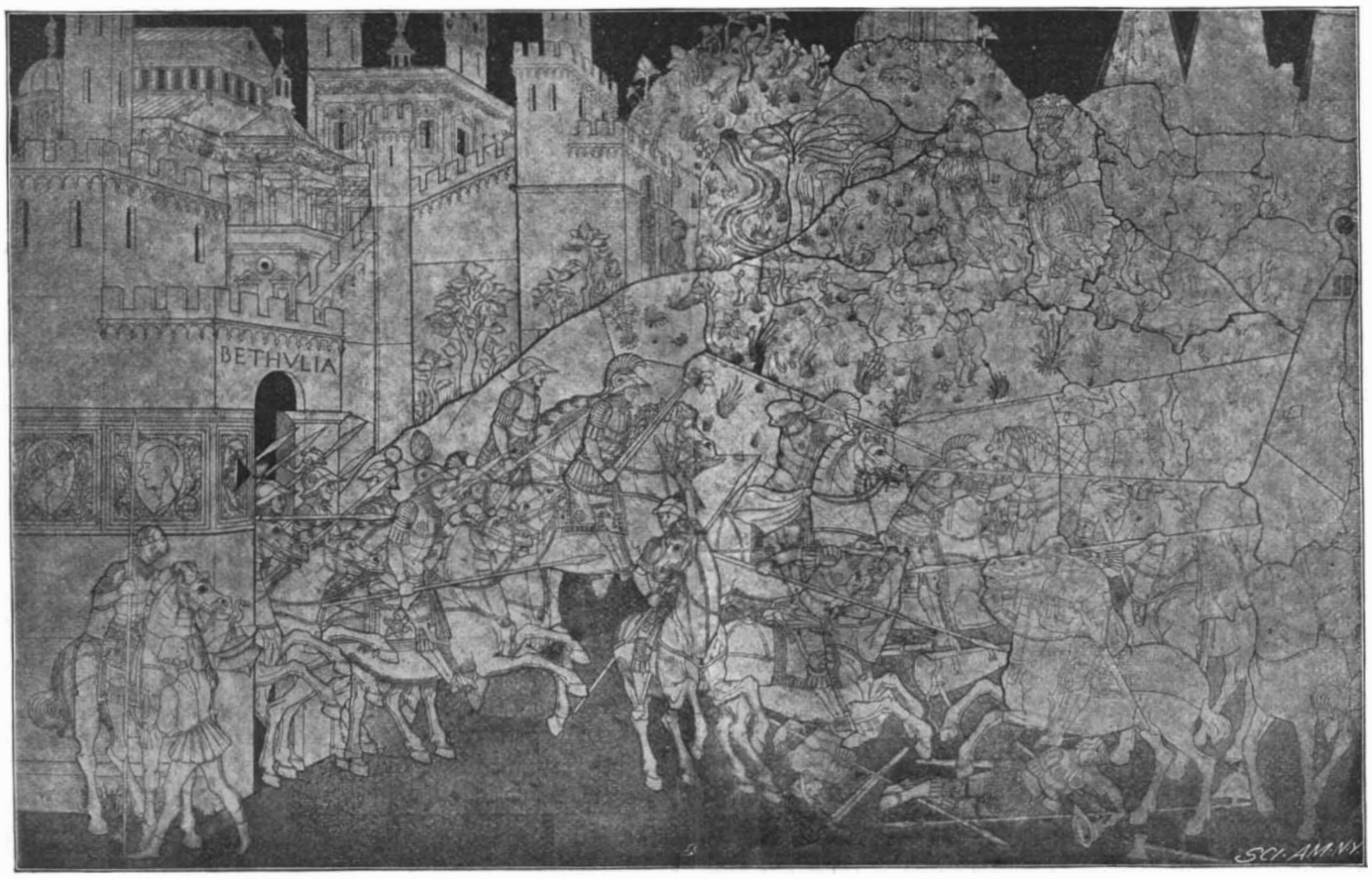
The local name, tiñosa, meaning scabby or scurvy, and hence anything that is repulsive or repugnant, expresses the prevailing idea regarding the fish; the dreaded disease, ciguartera, caused by eating poisonous fish, is also associated with this species in the popular mind. Poey himself, however, does not appear to have shared the current belief, for he writes that he has eaten the tiñosa and found it good. The prejudice against this species may thus be unjust, or it is possible that the toxic properties ascribed to it depend not on any inherent qualities of the flesh, but on ptomaines generated by a particular kind of food or by the rapid decomposition to which the tropical fishes are liable.

THE PAVEMENT OF THE CATHEDRAL OF SIENA.

It may, indeed, truly be said there are few of the works of man's hand which stand alone as examples of their kind, but art sometimes strikes an invention which is unique, which is brilliant, and which can be compared with no standard, but must be taken by itself. Such a work is the pavement of the cathedral of Siena. It is a marble floor wrought in every part with curious engravings or inlay or a mixture of the two. Day by day for hundreds of years men and women have worn the surface of this pavement with their feet and knees until at last all the most valuable part of it is covered with waxed cloths and planking. In portions where generations of worshipers have left too rude a mark, the pavement has been restored. In some cases the restoration has been done in good taste, and in others in bad taste. Careful tracings have been made of the whole, so that we can form an excellent idea of its appearance in its pristine condition.

On August 15 of each year, the feast of the Annunciation of the Virgin, the patron saint of Siena, and for a short time thereafter, the wood covering is removed, and it is really the only time when an adequate idea of the pavement can be obtained. But even this damages the pavement, for the writer was fortunate enough to be present on the date indicated above, and his foot knocked against a small piece of the pavement which had been crushed by some passerby, and he now retains this piece in his possession as a valuable souvenir. In brief, it may be said that the pavement consists of three varieties. First, engraved marble; second, inlaid marble; and the third ordinary mosaic. In the case of the figure subjects, a slab of white marble was cut to the proper size of the destined compartment and then it was strongly engraved or incised and the lines were then filled in with black mastic, so that the subject lies boldly outlined under the feet.

At the end of the thirteenth century Siena was the most illustrious of the Tuscan commonwealths and was master of a third of Etruria and a rival of Florence. The raising of great public monuments was common and the cathedral was begun on an enormous scale. In 1369 we have the first record of a pavement laid down in figured marble, and from that date until 1547 we can trace entry by entry, in the old parchments, the continuation of the work. The method employed in the earlier pieces would be called intaglio engraving, for the pieces of marble were treated in the way we have described. Borders, etc., were made of mosaic, and these borders were composed of variously colored marbles exquisitely cut according to the design. The success of the pavement depends upon the combination of the incised marble and the mosaic border. At first the methods employed kept the work simple, but by degrees it became more and more artificial. The general name "commesso" was given to the combined art. The earliest subjects are in the transept. They are not religious, but allegorical and political, the "Wheel of Fortune," which was particularly appropriate for Siena, beginning the series; then came emblems of cities, etc. The first regular figure subject dates from 1374 and is in simple outline, and fifty years later came great single figures of "Justice," "Fortitude," etc. The method now becomes even more complicated. Domenico di Niccolo, a wood inlayer, is called in from working on the choir stools and he does wonders for the pavement. Now come pictures of leaders of the Jewish faith, scenes from the Old Testament history, and at last contemporary subjects are reached. In four vast irregular compartments the artists of the city now designed inlaid scenes of carnage. The advance of the Renaissance is clearly shown in the scene which tallies with Dante's Vision of the Death of Holofernes and the overthrow of his host, which is shown in our engraving. Here the artist of the Renaissance, having just broken the thralldom of the middle ages, has delighted his imagination by piling up an infinity of classical temples and catacombs with statues on columns. The frieze is adorned with great medallions copied from the antique. One is believed by Mr. Sidney Colvin to be a portrait of Scipio Africanus. The artist has shown a great desire to express the actions of men and horses in strong movement, and while he has succeeded in doing this the composition is not a very powerful one. Judith and Holofernes are minor personages up in the top of the composition and would hardly be noticed if special attention were not called to them. The part of the composition showing the act of vengeance has been almost destroyed. Matteo di Giovanni's "Slaughter of the Innocents," in which considerable cross hatching is used, follows. Many of the designs were furnished by masters whose profession was



INLAID AND INCISED FLOOR OF THE CATHEDRAL OF SIENA.

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painting. Others were contributed by professed inlayers. The inlayers' work showed parables and allegories and they had much of pure gravity, and the only advance was in the ingenuity and richness of the borders. Beccafumi improved the technical processes by letting marble into the large plate of marble, using green marble for grass, yellow marble for earth, dark blue for negro slaves, and parti-colored fragments for ornaments and jewels. Strange to say, the effect is remarkably good, and it cannot be judged by the ordinary canons of criticism. In later subjects a step further was taken, and the effect of a black and white cartoon was obtained by using a gray marble which produced the heavy shadows. The lights were obtained by using light marble, and the dark features by black marble. The joints were most artificially concealed, and the transition from light to dark was shaded with engraved lines exactly as one might shade a drawing. The result is remarkably curious and pleasing. The landscapes are filled with incident and are highly finished. The severity and decorative abstractness which the old designs had maintained were now almost wholly lacking, and the conditions of the material were defied. The consequence is a surprisingly entertaining performance, which, while scarcely a true work of art, must be admired on its merits, and the history of Siena is really written in her pavement, which shadows her glorious promise, her rise, and the long delay of her inevitable doom.

A Department of Mineralogy and Mining.

Representative Osborne has introduced into Congress a bill providing for the establishment of an executive Department of Mineralogy and Mining. These subjects in the United States are of such great importance that there should certainly seem to be a legitimate field for the creation of another department.

"That there shall be established at the seat of government an executive department to be known as the Department of Mineralogy and Mining, the objects of which shall be to gather and diffuse among the people of the United States practical and useful information pertaining to mining in all its branches. Said department shall be under the supervision and control of an executive officer to be known as the Secretary of Mineralogy and Mining. Said officer shall be appointed by the President, by and with the advice and consent of the Senate. There shall be an Assistant Secretary of Mineralogy and Mining. The Secretary of Mineralogy and Mining shall receive the same salary as is paid to the secretaries of the executive departments of the government. The Geological Survey, as at present established, together with all records, maps and apparatus now connected therewith, shall be transferred to and made a part of the contemplated new department. This act shall go into effect and be in force on the fourth day of March next succeeding the day of its final passage."

Ship Canal Progress.

Among the ship canal projects which are making the most progress is the Russian canal from the Baltic to the Black Sea, work on which was commenced last spring. Four years will be required to complete it. It will be 1,080 miles long and 217 feet wide at the top and 117 feet wide at the bottom, and the depth will be 28½ feet. The canal will be lighted entirely by electricity, and the total cost will be estimated at about $100,000,000.

The Manchester ship canal has interested Belgians in a similar project for the benefit of the capital, Brussels. The project is now to make Brussels a great maritime port, with a basin of great size, to accommodate shipping. The canal will be about 75 miles long. The Belgians are among the greatest canal builders in the world, and a great deal of their commerce is carried on by means of twenty-nine canals.

The project of the Florida ship canal is still in abeyance. The total length of the Florida canal, as surveyed, is 108 miles.

The project for the canal to connect the Bay of Biscay with the Mediterranean does not seem to have made any progress. If this canal should be built, it would be 327 nautical miles long, and would be of immense importance for strategetic purposes.

The Kaiser Wilhelm canal, between the mouth of the Elbe, on the North Sea, and Kiel, on the Baltic Sea, is, however, more than paying its expenses, says The Sun, and the income of the Manchester canal is slowly increasing.

The extremely useful Isthmus of Corinth canal, which is only a little over three miles long, saves from one hundred to two hundred miles of the journey to Constantinople, and obviates the dangerous passage around Cape Matapan. It has not been utilized as yet as much as had been expected.

Trial of the New Submarine Torpedo Boat.

M. Lockroy, the French Minister of the Marine, has communicated to the press the fact that the new submarine torpedo boat "Gustav Zédé" succeeded in torpedoing with a dummy torpedo the French battleship "Magenta." He states that all on board the warship were in a state of great excitement, watching the surface of the sea; suddenly the cupola of the submarine boat appeared abreast of the battleship and about 4,000 yards distant. Before the guns of the warship could be trained upon her small antagonist, the submarine boat disappeared beneath the water. The "Magenta" was then ordered to steam ahead, and while she did this a blank torpedo from the submarine boat struck the warship below the water line.

The Current Supplement.

The current SUPPLEMENT, No. 1206, contains many most interesting articles, as "Coast Telegraphs and Space Telegraphy," by Rollo Appleyard. "Old Time Sugar Making in Louisiana" is an interesting article by Prof. H. S. Maring. "The Paris Cycle and Automobile Exhibition" is illustrated by engravings which show new types of carriages. "The Ethics of the Babylonians and Assyrians" is a lecture delivered by Prof. Morris Jastrow of the University of Pennsylvania and specially revised by the author. "The Evolution of the Strawberry" is an important paper by Prof. L. H. Bailey. The third lecture of Prof. Lewes on "Acetylene" is also given and is accompanied by most valuable tables. An article on "Typewriter Ribbons" completes the paper.

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RECENTLY PATENTED INVENTIONS.

Bicycle-Improvements.

BICYCLE.—WINDSOR O. CAMPBELL, Sulphur Springs, Ark. This invention provides independent pedal movements of the lever type, which afford means to adjust the length of the stroke of each pedal-lever while the bicycle is in motion. The invention also embodies novel quick-pitch screw connections for the pedals, with motor-gearing to drive the rear traction-wheel, and provides two-part traction-wheels and two-part tires for such wheels, together with means for joining the parts of the wheels quickly and holding the tire thereon.

Engineering-Appliances.

VARIABLE GOVERNOR CUT-OFF FOR ENGINES.—MARTIN O. ARNEGAARD, Hillsborough, N. D. In the present automatic cut-off governor, are included a vertically slidable shaft at the lower end of which a bar is so pivoted that its angle can be adjusted to the shaft. A rock-shaft having a crank, carries a guide for this pivoted bar, and is operatively connected with the valve-gear, in order to control the speed of the engine.

Mechanical Devices.

ELEVATOR AND CONVEYER.—GEORGE HAISS, New York city. This invention provides an apparatus by which material, such as coal, may be raised and conveyed horizontally, and dumped automatically at any desired point. To this end, the inventor employs an endless bucket-carrier, two runs of which are vertical and two runs horizontal. The lower horizontal run has a distributer for filling the buckets, so that the material is lifted to the upper horizontal run, where it may be dumped at any point and into any receptacle.

METRONOME.—JACOB C. DOERFER, Denver, Colo. Connected with a spring-motor driving a pin-cylinder, are sounding devices operated from the pin-cylinder. To control the speed of the motor, a governor of the wind-wheel type is employed. In order to decrease the speed of the governor, brushes having graduated bristles are employed, which are moved toward and from the governor from the motor.

DENTAL-PLUGGER.—ROBERT BLUM, Corpus Christi, Tex. The dental plugger has a tool or plugger point operated to deliver either a forward or backward blow by the action of a mallet block slidable in the casing or hand-piece, and propelled by a pneumatic engine or pump, which produces a pulsating or alternately expansive and exhaustive action on the body of air within the chamber of the handpiece of the plugger.

Railway-Contrivances.

RAILROAD CROSSING.—ERNEST H. HINER, Rogers, Ark. The rail-connection devised by this inventor, is adapted for use at the points of intersection of railroad-rails, and consists of a casing having a bearing, and slots concentric with the axis of the bearing. Depressible arms extend above the slots and have movable connection with a suitable support. A turntable is journaled in the bearing and carries a rail-section. There is an operative connection between the turntable and the arms, the connection comprising parts extending through the slots of the casing, and adjustable with the arms to different points of the slots, whereby the angle between the arms can be varied to correspond with the angle of the intersecting rails to be connected by the turntable rail.

REFRIGERATOR-CAR.—ANDREW J. MCARTHUR, Gainesville, Fla. The purpose of this invention is so to construct the ice-tanks of a refrigerator-car, that a large area of ice will be exposed to the interior of the car, in order that the heat of the load will be quickly condensed. Each of the ice-tanks has a circulating-coil extending along the wall of the car. A perforated pipe extends through the pair of tanks and has connection with the coil. Under each tank a tray is placed, the trays being connected by a pipe. One of the trays has a trap connection with the circulating coil. An overflow pipe extends from the coil at a point adjacent to the trap. A drain-pipe is connected with the lower portion of the coil.

STATION-INDICATOR.—RUDOLF SPERBER, Seattle, Wash. A cheap and simple arrangement has been provided in the present invention, whereby the streets or stations will be automatically indicated, the mechanism therefor being connected with and operated from the car axle. Means are provided for reversing the direction of movement of the belts at the end of the road. A bell is provided which is sounded at each change of street or station to call the attention of the passengers to such change.

Miscellaneous Inventions.

DISGUISING UNPALATABLE MEDICINES.—DANIEL F. DAVENPORT, Americus, Ga. This improved preparation for disguising unpalatable medicines is composed of balsam fir, shellac, alcohol, and olive oil. The pasty mass thus formed is heated and allowed to cool, and is then reduced to small particles and reheated.

SHELVING.—JAMES M. LIPPINCOTT and CLINTON S. HALL, Oakland, Ill. The purpose of these inventors is to furnish means for utilizing the space between the top of the ordinary shelving and the ceiling of the room by providing a shelf-section which can be moved vertically to a point above the fixed shelves and then moved laterally to a point above the fixed shelving. The vertically and laterally movable shelving-section has projections to enter guideways having vertical and lateral wings receiving projections at both the upper and lower ends of the shelving section. A counterbalanced cord has a movable connection with the shelving section whereby the stress of the counterbalance will not hinder the lateral movement of the shelves.

DIAPHRAGM FOR GAS-METERS.—JOHN HEARNE, Brooklyn, New York city, and CHARLES LAWSON, Boston, Mass. Diaphragms for gas-meters have been hitherto attached at their upper and lower edges to two similar metal rings, and constructed of two sections or pieces united by lap-seams. But this construction rendered them less flexible at two or more points and liable to leakage. The present invention provides a ring diaphragm, formed from a single seamless piece of leather. The improved diaphragm is free from these objections.

APPARATUS FOR DRAWING PUMP-RODS FROM WELLS.—JOSEPH E. GARVER, Rollersville, Ohio. In oil-fields it is often necessary for repairing or cleaning to draw the pump-rod from the well. This is usually done by means of a windlass operated by horse-power, a process which is not only slow, but inconvenient. The present invention seeks to provide means whereby the usual pump-power may be used for raising the rods. With this end in view, the inventor employs the horizontal movement of the rod or cable operated by the pump, to rotate a winding drum from which a rope extends to a connection with the rod to be drawn.

LUGGAGE-CARRIER FOR PACK-ANIMALS.—JOHN CALVERT, Dayton, Ohio. In this luggage-carrier for pack-animals, a back section is provided formed of parallel bars. To the back section and transverse bars a bottom section is hinged. Pivotally mounted braces between the back and bottom sections brace the latter. Chains are used in connection with the upper ends of the parallel bars of the back section. Hooks provided with rings engage the cross-trees of a pack-saddle, whereby the luggage-carrier on the pack-saddle can be moved.

FLUE-STOPPER.—BERNDT E. BENGSTON, Axtell, Neb. The flue-stopper consists of curved plates placed one upon the other, their concaved surfaces facing. Between the cap or cover plate and the opposing curved plate a connection is provided. A guide-device is secured to the curved plates and extends through the cover-plate. The cover-plate can be forced in the direction of the curved plates, to expand the latter, and in this manner to close the passage through the thimble.

HASP-LOCK.—WILLIAM M. VALENTINE, Glen Cove, N. Y. With a hasp is connected a locking-bar which is provided with a latch-head and which has sliding and pivotal movement upon the hasp. A keeper is adapted to receive the latch-head. Gravity lock-levers operated by a key are provided for the lock-bar and are located between the bar and hasp. A projection from the lock-bar is arranged for engagement with the lock-levers. By reason of this construction, the hasp-lock can be made to serve either as a latch or as a lock.

ACETYLENE-GAS GENERATOR.—MYRON E. SPRAGUE, Plymouth Union, Vt. The novel feature of this generator is found in the peculiar construction of the automatic cut-off valves. Above the generator a water-reservoir is placed, from the top and bottom of which, pipes lead to the generator. The reservoir has one of its sides in the form of a diaphragm. At the side opposite the diaphragm, the reservoir has a valve-seat in which a valve having a spring-controlled valve-stem is adapted to be seated. Water is fed to the carbid below by means of one pipe, and a portion of the gas generated is conducted by the other pipe to the reservoir. When the pressure becomes excessive, the diaphragm is pressed outwardly against the spring on the valve-stem and forces the valve against its seat, thus shutting off water from the carbid. When the pressure is reduced, the diaphragm by its action opens the valve and permits more water to flow through. By varying the tension of the spring the valve can be made to shut off the water at any desired gas-pressure.

PNEUMATIC CARRIAGE-BRAKE.—DANIEL P. SAMMIS, New York city. The purpose of this invention is to provide a mechanism for operating brakes upon carriages, which mechanism shall not require rods or similar devices to connect the brake-operating levers with the brake-shoes. With this object in view, the brake is operated by means of an air-cylinder. An air-pump is provided, which is located at any point convenient to the driver and provided with a lever which may be operated either by hand or foot. The air-pump and the air-brake-cylinder are connected by a pipe.

GATE.—OLIVER E. POTTER, Cameron, Miss. This gate is provided with improved mechanism for being opened from a distance, without dismounting from a horse or carriage. The gate is composed of two halves pivoted to swing toward and from each other, connections being provided so that the halves may be swung together. Upon the pivot of one half, a pulley is mounted. About the pulley a cord is passed. A bar mounted to reciprocate adjacent to the pulley has the cord attached to the ends thereof. Bell-crank levers are attached to each end of the bar and by their means the gate is either opened or closed.

SUPPORT FOR MATTRESS-FRAMES.—LOUIS PETRILLA, Brooklyn, N. Y. This invention provides such a support for the frames of spring or other mattresses that, when a mattress is in use, the weight will be equally sustained at each corner, thereby preventing the mattress's sagging and becoming permanently depressed at such places where a person is accustomed to lie. The invention also provides a spring or yielding support for woven-wire or similar mattresses, and a means for tightening the springs and the supports when desired.

APPARATUS FOR MAKING MOLDS FOR STONEWARE OR EARTHENWARE-JARS.—CHARLES KETTRON and FRED V. MAXWELL, Macomb, Ill. Heretofore it has been deemed impracticable to form a jar of clay or of like substance with a thread on its neck, the main difficulty being to form a suitable mold. These inventors have devised a method of forming a mold of plaster-of-Paris or other suitable substances to shape the top and neck of a jar, that portion of the mold adapted to shape the neck being provided with internal screw-threads.

TONGUE-SUPPORT.—EDWIN JARRELL, Riverdale, Kan. This invention is an improvement in tongue supports for wagons, and seeks to provide a simple construction which can be adjusted to suit the vehicle and the horses, which will automatically adjust out of gear in dumping the wagon, and which can be easily readjusted after the dumping is effected. The inventor provides a spring connection between the wagon and the tongue, link connections between the spring and the tongue, and an abutment for throwing the spring off the center or out of gear to free it from its supporting connection or position with respect to the tongue.

Designs.

VEGETABLE-MASHER.—CHARLES VAN WINKLE, Rutherford, N. J. The vegetable-masher comprises a bottom made of wire netting, the wires forming cutters, and a handle connected with the bottom. In using the device, the operator moves the bottom into contact with the vegetables, so that the vegetables are cut by the wires. The cut portions pass up through the meshes to allow a further descent of the bottom and consequent mashing of the vegetables. The masher is raised and lowered as many times as may appear necessary to mash the vegetables properly.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

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NEW BOOKS, ETC.

ON THE SPRINGING AND ADJUSTING OF WATCHES. By F. J. Britten. London: E. & F. N. Spon. New York: Spon & Company. Pp. 152. 12mo.

This volume contains a description of balance springing and the compensating balance, with directions for applying the springing and adjusting for isochronism and temperature. It is intended for those tolerably conversant with watch-making and those who desire guidance in this particular branch, rather than for beginners, and therefore a knowledge of the many elementary branches is assumed. While we are not particularly familiar with watch-making, we can see that the book is a fairly practical one for those who are engaged in this form of mechanics on a small scale.

A PRACTICAL ENGINEERING POCKET BOOK FOR 1899 Manchester, England: Practical Engineering Company, Limited. New York: D. Van Nostrand Company. 1898. Price 60 cents.

This annual compilation is an interesting little pocket book and contains considerable information not found elsewhere. If an engineer nowadays should have all the pocket books which are published, he would have a foundation for a fine engineering library. It is remarkable to see what excellent matter is contained in the different pocket books. The little volume before us is no exception to this rule.

PORTLAND CEMENT. ITS MANUFACTURE AND USE. By Charles D. Jameson. New York: Van Nostrand & Company. 1898. Pp. 192. 8vo. Price $1.50.

This monograph is the outgrowth of a short course of lectures delivered each year to the junior engineer students of the State University of Iowa, upon limes, mortars, and cements. The book deals in a clear and logical manner with the making of Portland cement, including the selection of raw materials, their proper treatment by the different methods, the burning of this material with the types used, testing of Portland cement, the comparative value of different cements, the use of Portland cement as a material of construction, the proper methods of manipulation, estimates of quantities, costs, etc. The book is eminently practical and scientific and is well illustrated by engravings which elucidate the text.

TWENTIETH CENTURY MAGIC AND THE CONSTRUCTION OF MODERN MAGICAL APPARATUS. With the Introduction of New Experiments, Mechanical, Chemical, Electrical, etc. By Nevil Monroe Hopkins. New York and London: George Routledge & Sons, Limited. 1898. 12mo. Pp. 160, 100 illustrations. Price $1.

The volume before us is a collection of magical tricks divided into mechanical, chemical, and electrical tricks. It is written by an amateur and is dedicated "To the Amateur Conjurers of America and England." It should be said in the beginning that it is an entirely different work in scope from "Magic: Stage Illusions and Scientific Diversions, Including Trick Photography," of our Mr. A. A. Hopkins. "Twentieth Century Magic" deals rather with clever tricks devised in the laboratory, while our "Magic" concerns rather the actual tricks of the prestidigitateur, which were in many cases furnished by the magicians themselves, or by their master machinists. Having noted the marking distinction between the two books to prevent confusion, we have no hesitation in saying that "Twentieth Century Magic" is an admirable collection of new and clever tricks, and, as the author says, it is primarily designed to furnish an additional field for the amateur to operate in as well as constructive occupation, if he has a mechanical turn of mind. As such it will undoubtedly prove of value to the amateur, and the professional conjurer may also glean some valuable hints which will doubtless prove useful to him. The illustrations are very largely in the line of working drawings and serve to admirably elucidate the text. It is tastefully printed and bound.

PROCEEDINGS OF THE TENTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS. Washington: Government Printing Office. 1898. Pp. 104.

The work which is done by the government alone in practical entomology is simply enormous and is highly creditable to Dr. Howard and his assistants. The present pamphlet is the proceedings of the meeting which was held in Boston, August, 1898, and contains a number of papers of interest to all who are in any way connected with practical entomology.

DIE TECHNISCHE VERWERTHUNG DES STEINKOHLENTHEERES. Nebst einem Anhange: Ueber die Darstellung des natürlichen Asphalttheeres und Asphaltmastrix aus den Asphaltsteinen und bituminösen Schiefern, sowie Verwerthung der Nebenproducte. Von Dr. Georg Thenius. Vienna: A. Hartleben. Pp. viii, 216. 8vo. Price 60 cents.

The rapid development of organic chemistry within the last forty years has been largely due to the particularly exhaustive study of certain organic bodies. The thorough examination of comparatively few compounds has been sufficient to bring about radical changes in chemical theories. Among these organic bodies should be mentioned the products of the distillation of coal tar, many of which have played a not unimportant part in technical chemistry. Substances such as benzol, phenol, naphthalin, anilin, and the other derivatives of coal tar, have been extensively used in many industries. For many years the author of this work has been engaged in the manufacture of benzol, nitrobenzol, phenol, anilin, and other coal tar products, and of asphalt and asphalt cements; for this reason the second edition of the "Steinkohlentheere," containing as it does information obtained from the experience of years, should be of more than usual interest to chemists engaged in the making of coal tar.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(7587) A. C. S. writes: I have several cells of bichromate of potassium battery, so arranged that the zincs can be raised from the solution when not in use. The rods and zinc holders are made of brass. After being charged a few days a salt begins to cover the parts mentioned and I fear will, after a time, destroy them. With what shall I coat the brass parts to properly protect them from the action of the acid? A. To prevent the acid of a battery from climbing and reaching the brass fittings, proceed as follows: Dip the upper end of the carbons in melted paraffine till they are completely saturated for an inch with paraffine. Coat the upper end of the zincs with asphaltum varnish. Of course, the cells must be taken to pieces and the plates thoroughly washed and dried before treating them.

(7588) F. A. B. asks: 1. Would four cells of battery, each giving 1·75 volts and 6 amperes, when connected in series give a total of 7 volts and 6 amperes? A. Yes. 2. Would this light six 7 candle lamps (connected in parallel), each of 7 volts and 1 ampere? A. Yes, theoretically, but practically, no. 3. About how long would an ordinary battery of this size run that number of lamps? A. Any battery used in this way would run down very rapidly. It is like taking the dam of a reservoir away all at once for the purpose of drawing out the water to turn a mill. The water runs out all at once. The cell is used up all at once.

(7589) G. S. Y. asks: How is rubber dissolved for the use of moulding tips for crutches, shoes, etc.? A. Rubber is not dissolved, but is vulcanized into shape. We can send you an important series of papers on rubber manufacture on receipt of 30 cents, which will give you full information regarding the manufacture of such articles as you mention.

(7590) "Subscriber" describes a dynamo casting which he has, and asks how to wind it for series and for compound winding, both of field and armature, both for battery current and for 100 volt circuit. He finally asks what would be candle power generated by it. The whole frame is only 4½ inches long. A. The machine is a toy of no real use. Wind it up with No. 26 or 28 magnet wire. A cell or two of battery will make it turn. SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, price 10 cents, contains drawings of connections, armature, etc., to show you how to proceed.

(7591) A. A. C writes: I wish to stain a number of glass electric light globes. What chemicals shall I use, and how use them? Red, blue, and green are the colors I wish to use. A. 1. Prepare the glass by thoroughly washing in soap and water and drying. Then dip in bath made by beating up the whites of two eggs in 1½ pound or pint of water and filtering, and hang up to dry. Dissolve the aniline color in photographer's common collodion. 2. Red or blue aniline will form clear solutions, while the green solution will require filtering. 3. Yellow aniline forms a handsome color, but the surface of the glass presents a frosted appearance after the application. 4. Violet and purple colors may be obtained by combining red and blue in different quantities. When the solution is ready, dip the prepared glass bulbs therein, hang up to dry, and finally pass a current through the bulb for half an hour, that the heat thus generated may harden the coating of the collodion, or place in a current of air. 5. The preparation can easily be removed with alcohol or sulphuric ether, but is not affected by water. Experience has shown that the best results are obtained by not using too much aniline. Make the color light rather than deep, and apply two or three coats.

(7592) L. P. asks: 1. What are the methods for making the different kinds of imitation woods? A. Imitation woods are made by staining and by the grainer's art. See our "Cyclopedia of Recepts" for a full account of staining and graining imitation of all kinds of wood, $5 by mail. 2. Why is it that the lowest part of music sung by female voices is the alto, while if played on an instrument it is the tenor? A. We cannot agree with your statement concerning the parts in music as sung and as played. Alto as sung does not become tenor when played, though the ranges of the alto and of the tenor have many notes in common. The usual range of the parts in music, as given in the "Encyclopedia Britannica," vol. 24, is as follows: Bass, from F below bass C to include middle C; baritone, from A below bass C to include E above middle C; tenor, from bass C to include G above middle C; alto or contralto, from E below middle C to include B above middle C; mezzo soprano, from G below middle C to include D of octave above middle C; soprano, from B below middle C to include F of octave above middle C. By this table you will see that even bass and soprano have two notes in common, B and middle C, but a bass voice does not become soprano by singing middle C.

(7593) J. H. B. asks: Has any substance, either animal, vegetable, or mineral matter, either liquid or solid, ever been discovered or manufactured which can resist and is not penetrated by the electric waves which pass through the ether? A. We suppose that electric waves to some extent penetrate most substances, but not with equal ease. Electric waves are also reflected by sheet metal, refracted by a lens of pitch, and polarized by gratings of parallel wires. All these changes suggest a degree of resistance to the waves which retards them, and in the end would stop them. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 718, 720, 734, 967, 968, 969, price 10 cents each, for the work of Hertz; "Elementary Lessons in Electricity," Thompson, price $1.40, and Lodge's "Modern Views of Electricity," price $2.

TO INVENTORS.

An experience of fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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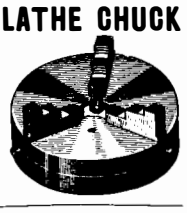

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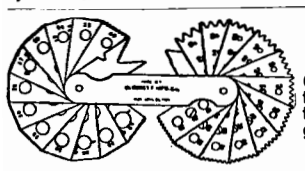

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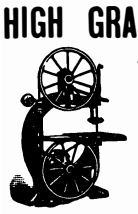

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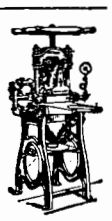

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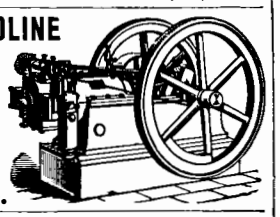

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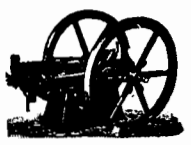

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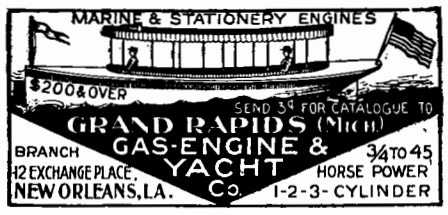

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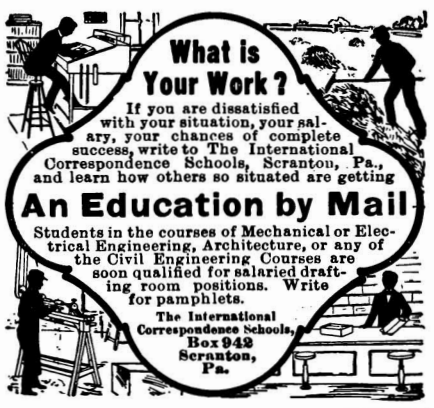
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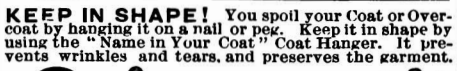

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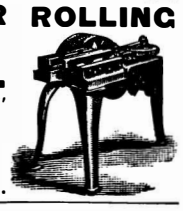

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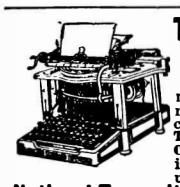

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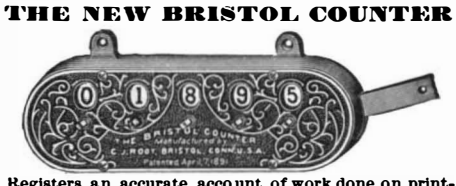

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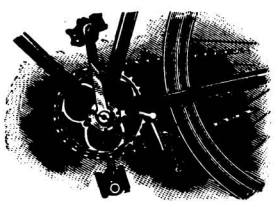

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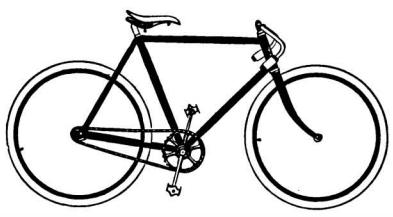

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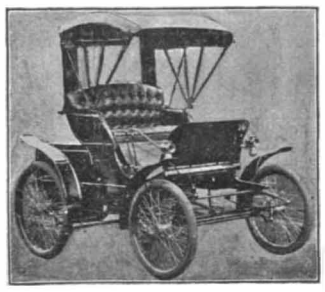

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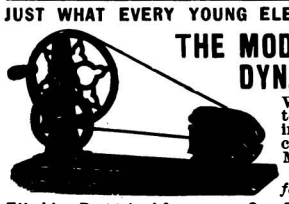

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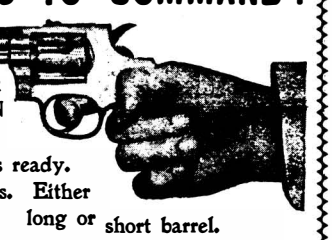

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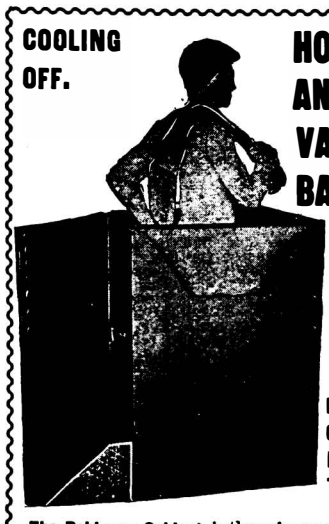

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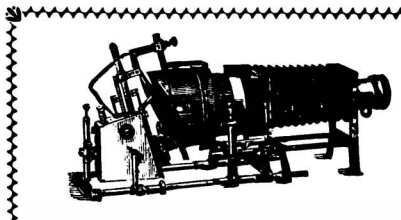

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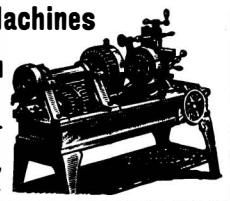

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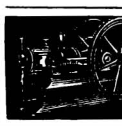

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